OUTDOOR HANDICRAFT FOR BOYS

OUTDOOR HANDICRAFT FOR BOYS

PRACTICAL PROJECTS FOR ALL THE YEAR

BY

A. NEELY HALL

Author of "Craft Work-and-Play Things," "Home Handicraft for Boys," "The Boy Craftsman," "Home-Made Toys for Girls and Boys," "Home-Made Games and Game Equipment," "Handicraft for Handy Boys," "Handicraft for Handy Girls," "The Handy Boy," "Carpentry and Mechanics for Boys," "Outdoor Boy Craftsman," "Big Book of Boys' Hobbies," "Making Things with Tools," etc.

WITH OVER FOUR HUNDRED
PHOTOGRAPHS AND WORKING DRAWINGS
BY THE AUTHOR

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TO MY BROTHER

NORMAN P. HALL

companion craftsman since
we were kids

PREFACE

We are all boys when turned loose out of doors, and the difference of a score or two of years makes little difference in the enjoyment of activities. True, if we have developed a wider girth, increased weight and stiffened muscles, we no longer have the agility or wind of youth, yet there may be compensations that offset these handicaps. Our greatest asset may be a son, or two, if you please. Such an acquisition awakens the desire to realize dreams of boyhood and furnishes the alibi for diverting a portion of the family budget to a fund for outdoor handicraft. And, boy, to what lengths that alibi may be worked! No objection is raised to our building projects for the boys, no arguments started against our buying a lake-site lot where the boys may spend vacations close to nature, no disapproval of our adding a cottage, boats, a skiboard, aquaplane, diving raft and other devices that will give the boys training in building, and opportunity to enjoy the lake to the full.

The boys cast the final vote in the matter of camping. Fishing becomes a major family interest. Back at home we have help in furnishing the grounds with bird houses and baths, and gadgets, indeed, which we never had thought of. We see the model yacht that we have had in mind these many years take shape and we go out and help the boys sail it with-

out fear that we may be reproached. We help t build kites and model airplanes and pushmobiles. . bobsled, an ice-yacht and skate sails are on the wor shop schedule, too. Indeed, winter and summer, ar the seasons between, find us with the car and tl boys on some mission bent, trying out homema sports equipment or looking into the possibilities spending leisure in new and thrilling ways out doors.

This Father and Son partnership may be carri on profitably, with our mature judgment to temp youth's zeal and the boy's eagerness to whet o enthusiasm, with our thrift to curtail extravagan and the boy's faculty for persuading us to loosen u with our purchasing power and the boy's uncan information about what to buy and where to buy cheapest, with our experience in organizing a j and the boy's knowledge of new methods, with o limited time for laying out work and the boy greater leisure for cutting and assembling parts.

But while this relationship between Father a Son is ideal, there will always be a larger number partnerships between brothers and between boys a their chums, and a still larger number of lone wo ers. And thousands of boys will confine their han craft activities to those of manual training class Boy Scout patrols, 4-H Clubs, Y.M.C.A., commun playground, Rotary, Kiwanis, Lions Clubs and otl organization groups. Taking all this into conside tion, the author has prepared *Outdoor Handicr for Boys* with a view to providing a large vari of seasonal projects that require inexpensive ma

rials and that can be made with the hand tools to be found in the average household. As the "How to Make It" Editor of *Science and Mechanics*, "For the Boys to Make" Editor of *The American Boy*, "Workshop" Editor of *Modern Mechanix*, contributor to *Popular Science Monthly*, *The Country Gentleman*, etc., and contributing editor of a score of boys' weeklies and newspapers published in the United States, Canada and England, the author has had a very wide reader contact, and believes that the projects in the thirty-two chapters of this volume, illustrated with more than four hundred photographs and working diagrams, will satisfy every lone craftsman and every group of craftsmen interested in building equipment with which to enjoy in a fuller measure the great out of doors.

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Acknowledgment is made of assistance received from B. C. Friedman, model airplane instructor, from A. N. Thorsen, builder of the Sea Gull model yacht, and from my nephew Jack Soderberg, in the preparation of *Outdoor Handicraft for Boys*.

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SPRING OUTDOOR HANDICRAFT

Chapter I

OUTDOOR MODEL AIRPLANES

An Outdoor Tractor Model—An Outdoor Twin-Pusher Speed Model—Model Aircraft Classifications and Competition Rules

SINCE outdoor flying fields are always at hand, while indoor flying must be confined to gymnasiums and public halls on the rare occasions when they are available, your larger interest in model airplanes will naturally be in outdoor types.

AN OUTDOOR TRACTOR MODEL

The tractor model in Fig. 1 is a sturdy little rise-off-the-ground plane that will fly equally well outdoors or in. It has been built to outdoor specifications and will take a lot of punishment from wind and crashes.

THE MATERIAL. Figure 2 lists the materials needed. I have specified a piece 1/16 inch by 2 inches by 24 inches for the wing, elevator and rudder spars and ribs, instead of strips of the required widths and lengths, because that is the cheaper way to buy. You can easily rip the strips from the large piece with a razor blade.

Figure 3 is a plan of the assembly, Fig. 4 is a front view and Fig. 5 a side view.

THE WING. Figure 6 shows a plan of the wing

and Fig. 7 an edge view. Cut the spars and ribs of the sizes marked. Notice that the wing has a *sweep-*

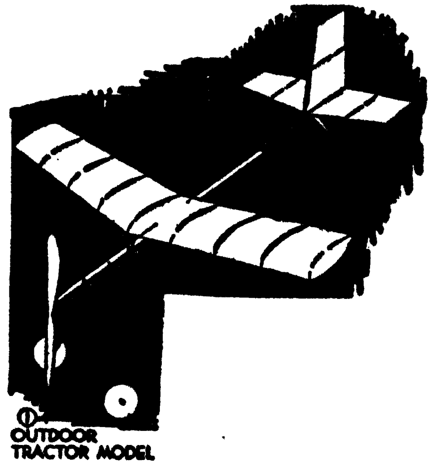


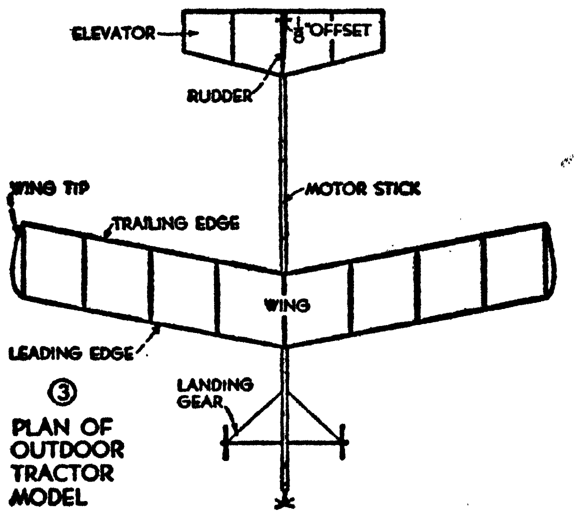
FIG. 1. OUTDOOR TRACTOR MODEL

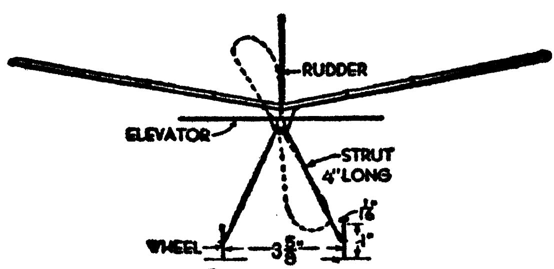
QTY.	SIZE	MATERIAL	PART
1	1/16" x 2" x 24"	BALSA	SPARS, RIBS, ETC.
1	1/8" x 1/4" x 10"	"	MOTOR STICK
1	1/8" x 1/8" x 3 1/4"	"	TAIL BOOM
1	5/8" x 1 1/4 x 6"	"	PROPELLER BLOCK
1	HALF SHEET	TISSUE	COVERING
1	12" NO. 8	MUSIC WIRE	METAL PARTS
1	1/32" x 1/8" x 20"	RUBBER	MOTOR
	1/8"	BRASS	THRUST WASHERS
		CEMENT AND BANANA OIL	

FIG. 2. MATERIAL LIST FOR THE OUTDOOR TRACTOR MODEL

back of 1½ inches. The sweepback increases the model's stability. To produce it, notch the leading

edge of each spar the correct amount (Fig. 8) and add a drop of cement at the notch to make the bend permanent.





FIGS. 3-4. PLAN AND FRONT VIEW OF THE OUTDOOR TRACTOR MODEL

CAMBER THE WINGS as shown in Fig. 9. With a metal templet cut to the arc of the rib, it is easy to run a razor blade along the curve and get the

camber of the ribs uniform. In addition to the nine ribs, cut the wing tips of the shape and size shown in Fig. 10.

To ASSEMBLE THE WING, cement all but the center rib between the spars. Then add the tips. The wing must have a dihedral as well as the sweepback. To produce this, cut the center of each spar half-way through on the bottom, and bend up the halves.

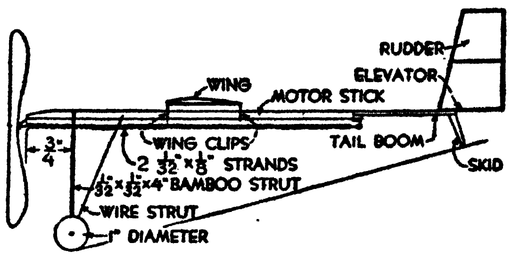


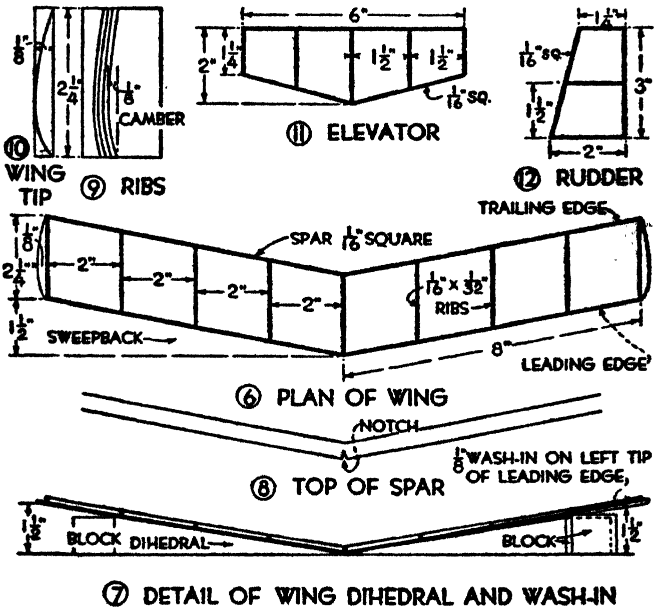
FIG. 5. SIDE VIEW OF THE OUTDOOR TRACTOR MODEL

This will crack the balsa, but a drop of cement applied to the top and bottom at the point of bending will restore the unity. Block up the wing ends as in Fig. 7 so that the wing tips will be 1½ inches higher than the center, with the left tip of the leading edge raised an additional ⅛ inch to produce a wash-in. The wash-in is necessary to offset the torque produced by the right-hand propeller. When you have shaped the wing frame, cement the center rib in position.

THE ELEVATOR AND THE RUDDER. Make the elevator frame as shown in Fig. 11 and the rudder as shown in Fig. 12. The ribs are straight.

PAPERING. Use Japanese tissue paper for cover-

ing the frames. There are three ways to paper the wing. One way is to cover only the upper surface. A second is to cover both surfaces, following the curve of the ribs. A third is to cover both upper



FIGS. 6-10. DETAIL OF WING
FIG. 11. PLAN OF ELEVATOR
FIG. 12. PLAN OF RUDDER

and lower surfaces, extending the lower papering from spar to spar. This produces an airfoil of deep section with curved top and flat bottom. You may cover one or both sides of the elevator and rudder frames.

PREPARE THE MOTOR STICK by the dimensions in Fig. 13. Notch the tail end of the stick, cut the *tail*

boom of the given dimensions to fit in the notch and cement it in place.

THE PROPELLER. Figure 14 shows the steps in carving the high-pitched propeller. Cut a block of the dimensions given in Step 1. Rule off its top and bottom surfaces with diagonal lines, as in Step 2, to locate the hub center, and draw two parallel lines 1/8 inch apart to mark the width of the hub. Draw diagonal lines across the block ends to locate the plane of the blades. These lines must be in opposite directions, and the direction will determine

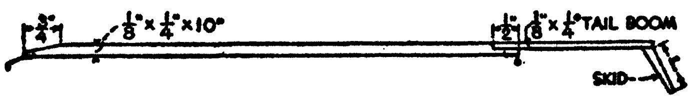


FIG. 13. DETAIL OF MOTOR STICK

whether the propeller is to be a right-hand propeller or a left-hand propeller.

CARVING. A very sharp knife and an oilstone on which to keep the blade whetted to a keen edge are needed for the carving; also, skill in whittling, which can be obtained only by practice and patience. Your first propeller may be a failure, your second should be fair, and the third should pass inspection.

Step 3 is to cut away the sides of the block close to the diagonal lines. You can do this with a saw or knife. Steps 4 and 5 are to carve opposite edges of the upper surface of the block to the plane of the end diagonal lines. Step 6 is to carve the lower surface similarly. After carving the blades, finish up with sandpaper, rubbing one side concave and the other convex. Step 7 is the final trimming. Re-

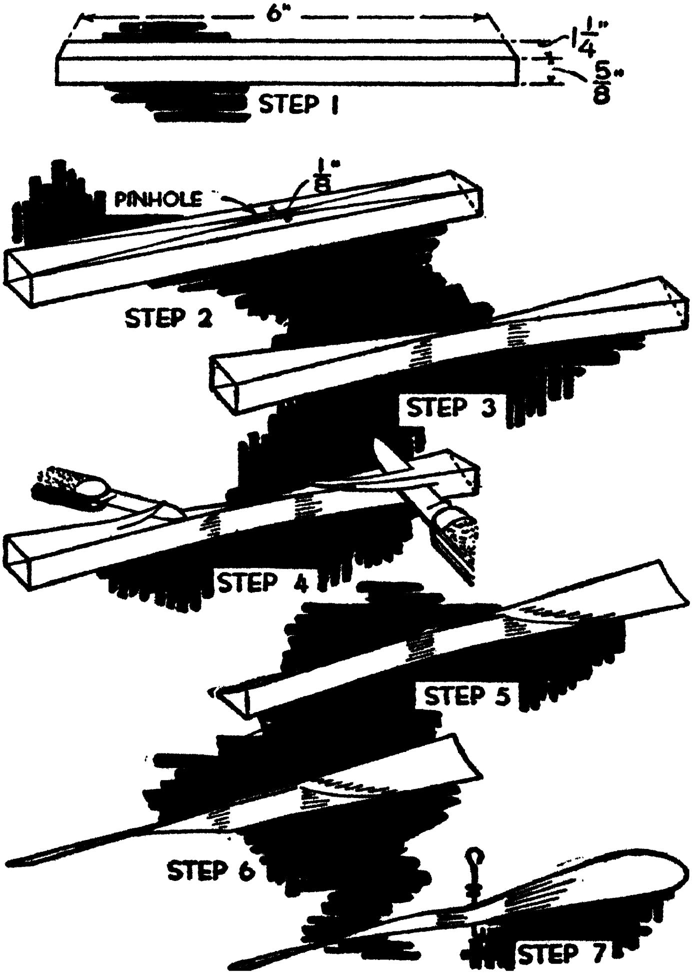
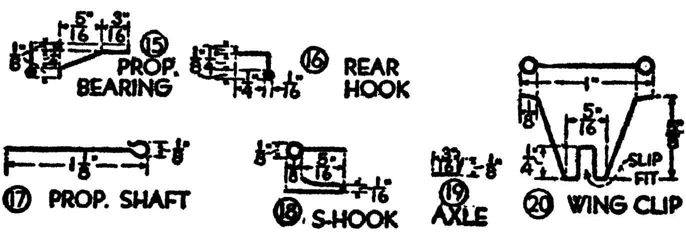


FIG. 14. STEPS IN CARVING THE PROPELLER

duce the width and thickness of the hub as much as it will stand. You can cut it away on the inside without weakening it. Round off the blade tips.

SHAPE THE METAL PARTS NEXT. These are to be bent out of number 8 music wire. Use a pair of long-nosed cutting pliers for the shaping.

Make the *propeller bearing* of the shape and size shown in Fig. 15, the *rear hook* of the shape and size shown in Fig. 16. Coat them with cement and



FIGS. 15-20. DETAILS OF METAL PARTS

set their pointed ends into the motor stick as in Fig. 13. Figure 17 shows the *propeller shaft*. Make an *S-hook* like that shown in Fig. 18.

Prepare a pair of *wing clips* like that in Fig. 20, with the center square loop of the right size to make a slip fit over the motor stick. The end loops are shaped to fit upon the wing spars. Cement them to the spars as shown in Figs. 4 and 5.

THE LANDING GEAR. Make a pair of *wire axles* like that in Fig. 19 and cement them to the *landing gear struts*, which are bamboo strips 1/32 inch square and 4 inches long. Cement the struts to the sides of the motor stick where shown, with the span indicated. Brace with wire diagonals as shown in Fig. 5. Cut wheels of the size shown, slip them

over the axles and add a drop of cement to keep them from slipping off.

To complete the landing gear, cut the tail skid of the size shown in Fig. 13 and cement it to the tail boom.

ASSEMBLING. With the parts completed, cement the elevator and rudder to the tail boom, offsetting the rudder 1/8 inch as indicated to counteract the propeller torque. To mount the wing, slip the wing clips over the motor base.

TO MOUNT THE PROPELLER, stick the straight end of its shaft (Fig. 17) through the hub hole, bend a square hook on the wire end, coat this hook with cement and draw its point back into the hub.

THRUST WASHERS. Use two 1/8-inch brass washers. Cement one to the propeller hub and let the other run free on the shaft.

THE MOTOR. Use a two-strand length of 1/32-inch by 1/8-inch rubber for the motor. Knot its ends with a square knot and loop it over the propeller hook and the S-hook, with the knot at the latter hook. Slip the S-hook through the eye of the rear motor hook.

TUNING THE MODEL. The model should now be ready to try out. First, test it as a glider, and adjust the wing to the point at which the best flight is obtained. If the model dives at a steep angle, move the wing a trifle forward. If it climbs steeply, stalls and slips back, move the wing a trifle back. Because the wing clips make a slip fit over the motor base, you can easily shift the wing back and forth

and up and down. A fine variation in elevation can be obtained by slipping the front clip up and down.

To MAKE A MOTOR TEST, wind the rubber motor by turning the propeller with your finger about two hundred turns clockwise, watching the knots as they form to prevent their bunching. Place the model upon the ground, release your hold on the propeller and motor base, and the model will take off.

AN OUTDOOR TWIN-PUSHER SPEED MODEL AIRPLANE

Here is a twin-pusher type of model airplane that has been designed for speed. Shape and assemble the parts as shown in the accompanying diagrams, with particular attention to such details as building the framework symmetrical and true, cutting opposite halves of the elevator and wing alike, carving right and left propellers of identical size and pitch, and bending neat wire fittings.

THE MATERIAL. Figure 21 shows the model in position of flight and Fig. 22 shows a plan of the completed assembly. This is an all balsa model, except the propellers, which should be carved from white pine or a hard grade of balsa. The parts and sizes required are given in Fig. 23. If you cannot get balsa of the right width for the wing, cement two narrower strips together.

THE A-FRAME. After cutting the A-frame side sticks and beveling the nose ends so that they fit together as shown in Fig. 24, mark off the spacing for the gussets and braces, using the given dimensions. Cement the nose ends together and cement

the bamboo brace between the other ends. Then take the measurements for the gussets and intermediate braces. Cut these pieces and cement them between the frame sticks.

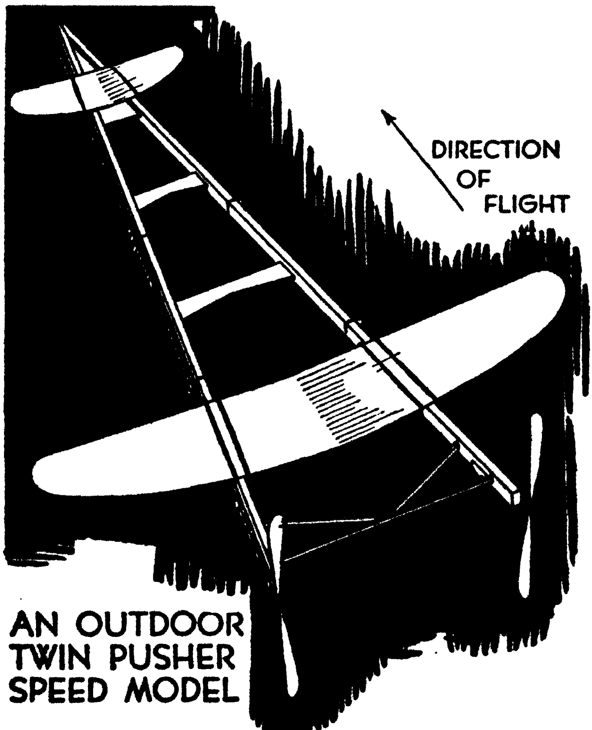


FIG. 21. AN OUTDOOR TWIN PUSHER SPEED MODEL

THE PROPELLERS. The size of the propeller blocks is given in Fig. 25. Lay out one for a right-hand, the other for a left-hand propeller, and carve them in the usual way, shown step by step in Fig. 14.

THE METAL PARTS. Figure 26 shows the size and

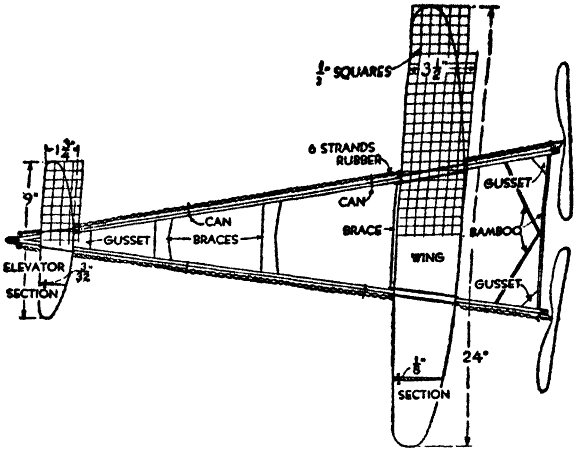


FIG. 22. PLAN OF THE OUTDOOR TWIN PUSHER SPEED MODEL

QTY.	SIZE	MATERIAL	PART
2	3/16" x 3/8" x 30"	BALSA	A-FRAME
1	1/8" x 3 1/2" x 24"	"	WING
1	3/32" x 1 3/4" x 9"	"	ELEVATOR
1	3/16" x 2" x 24"	"	BRACES, ETC.
2	1/16" x 1/4" x 10"	BAMBOO	BRACES
2	1/2" x 1 1/4" x 8 1/2"	W. PINE	PROP. BLOCKS
4	1/8"	BRASS	WASHERS
	24" NO. 14	MUSIC WIRE	METAL PARTS
	30' 1/32" x 1/8"	RUBBER	MOTOR
	CEMENT AND BANANA OIL		

FIG. 23. MATERIAL LIST FOR THE OUTDOOR TWIN PUSHER SPEED MODEL

THE SIZE TO BUILD IT is not important. Figure 33 shows a 36-inch model, a good average size. If you want a larger kite, increase all given dimensions proportionately.

THE STICK MATERIAL. Almost any straight sticks of the dimensions given in Fig. 34 will do. They

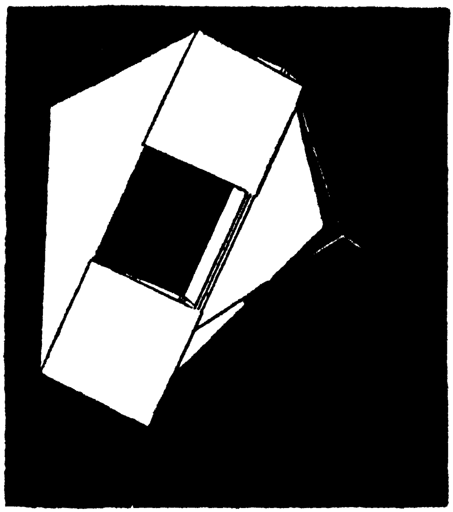


FIG. 33. POSITION OF CONYNE KITE IN FLIGHT

are too long to cut satisfactorily with a knife, so either saw them from a board or ask the owner of a power circular saw to rip them for you. A 6-foot length of lattice strip obtained at the local lumber yard will provide the sticks required and a spare or two for replacements.

THE FOUR STICKS are of equal size (Fig. 34). Stick A supports the leading edge of the triangular cells (Fig. 35) and needs no notching. Sticks B, C and D

must be notched to receive the framing string of the hexagonal plane (Fig. 36). After notching the

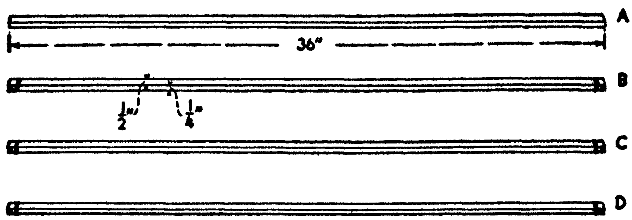


FIG. 34. DIMENSIONS OF STICKS FOR CONYNE KITE

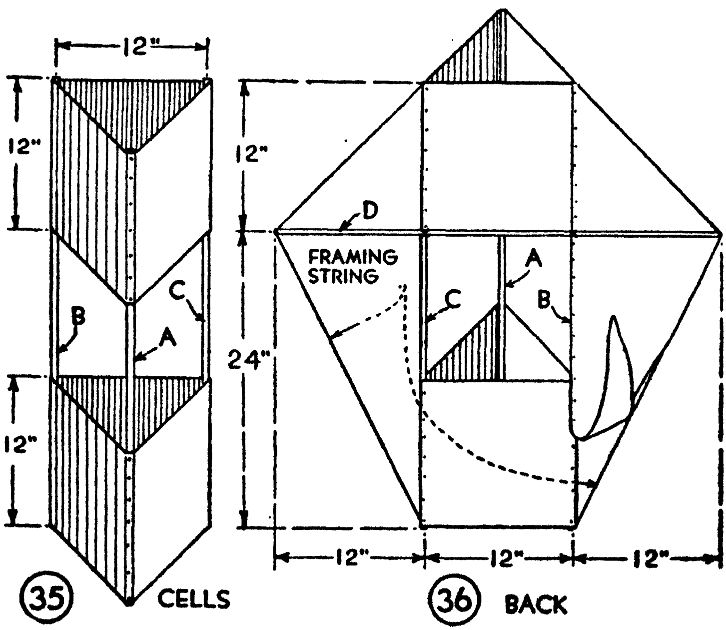
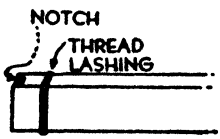


FIG. 35. ASSEMBLY OF TRIANGULAR CELLS
FIG. 36. BACK OF CONYNE KITE

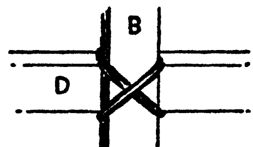
sticks, lash their ends with thread as shown in the detail of Fig. 37. A coating of shellac will hold the

lashings in place. You can make a neat job of notching with your coping-saw.

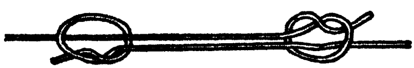
To FORM TRIANGULAR CELLS tack two strips of light-weight cambric, other closely woven cloth, or wrapping paper, cut 12 inches wide, to sticks A, B and C. Place the strips even with the stick ends, and make the spacing of the sticks 12 inches from center to center (Fig. 35).



37 DETAILS OF ENDS OF STICKS B, C, D



38 STICKS LASHED



39 JOIN LINE WITH FISHERMAN'S KNOT

FIGS. 37-39. DETAILS OF KITE STICK LASHINGS AND FLYING LINE KNOT

THE WING FRAMEWORK. Center cross stick D upon sticks B and C, at the bottom of the upper cell covering, and fasten with thread lashings, as shown in Fig. 38. Fasten framing strings to one end of sticks B and C, run them through the notches in the ends of stick D, pull taut and tie to the opposite ends of sticks B and C.

THE WING COVERING requires two triangular pieces of cambric, or other material used for cells. Tack the inner edge of one piece to stick B and the inner

edge of the other piece to stick C. Then lap the outer edges over the framing string and sew.

THE BRIDLE ATTACHMENT. Figure 40 shows the two-point attachment for the bridle. Make the loop of the right length to reach a trifle beyond and below the end of the cross stick when pulled to one

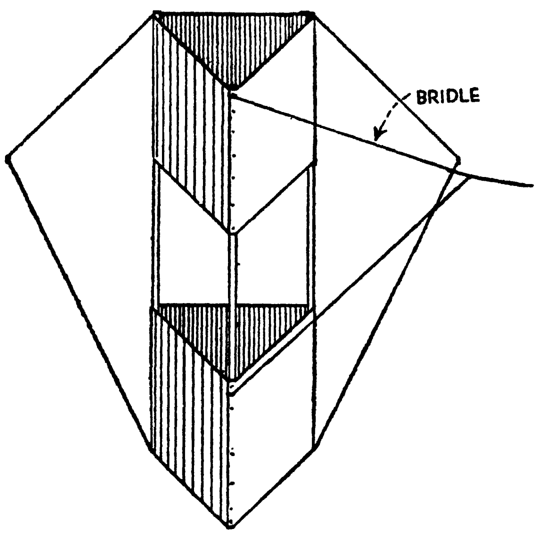


FIG. 40. ATTACHMENT OF BRIDLE

side as in Fig. 40. Join the line to the bridle with a fisherman's knot (Fig. 39). Mason's twine, fishing line, or other strong string is required for flying a kite of this size.

A BOX KITE

Although the Conyne kite is a box type of kite, what is generally known as a box kite is shown in

Fig. 41. It was invented by Lawrence Hargrave of Australia, an experimenter in aeronautics, the latter part of the past century.

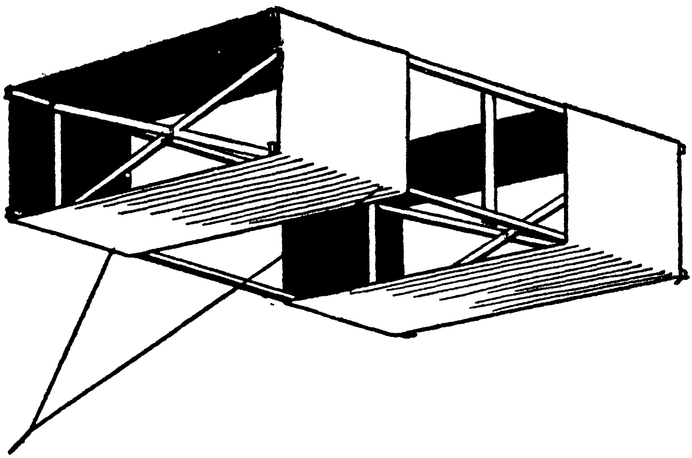


FIG. 41. BOX KITE IN FLIGHT

THE STICK MATERIAL. The box kite consists of two frames like that in Fig. 42. Notice that the horizontal sticks or spars are specified ¼ inch thick,

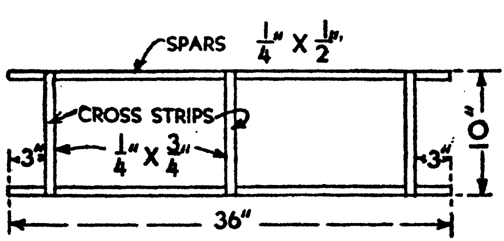


FIG. 42. SIDE FRAME DETAIL

½ inch wide and 36 inches long, and that the vertical sticks are of the same thickness, ¾ inch wide and

10 inches long. If the lattice strips or other stock that you rip is $\frac{5}{16}$ inch thick, the slight increase in thickness will not matter. In addition to the frames, there must be four diagonal struts of the same thickness and width as the frame cross strips and about 26 inches long, a length that allows for fitting.

The Side Frames. Nail the frame cross strips to the spars with short slender brads, in the positions indicated in Fig. 42. It is essential that the strips be joined at right angles, so check up the corners to make certain that they are right angles. When you have assembled one frame, build the second frame upon it, to get the pair alike. It will make stiffer frames to reënforce the connections with glue, or to bind them criss-cross with thread.

The cell covering may be of cambric, other closely woven cloth or wrapping paper. Two bands 10 inches wide and 68 inches long are required. Hem the cut edges to make them firm and to prevent raveling. Sew together the ends of the bands with a double row of stitching, lapping the material so that the measurement around the inside of the finished bands will be 68 inches. Of course the bands must be alike.

The Assembly. Figure 43 shows the completed assembly, with the end cell covering indicated by dotted lines. Slip the bands over the frames as shown in Fig. 44. Then spread the frames until the bands are stretched taut, and measure the diagonal distance between the frames to determine the

length for the struts. Cut the struts 1 inch longer than this measurement. Notch one end of each strut (Fig. 45), slip it into place over a spar (*Fig.* 46) *and trim off and notch the other end to fit over* the spar diagonally opposite. It is important to cut

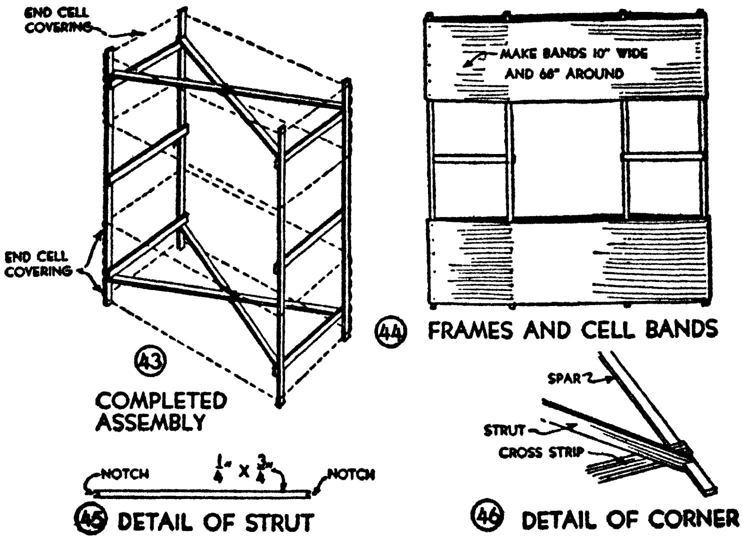


FIG. 43. COMPLETED ASSEMBLY OF BOX KITE FRAMEWORK
FIG. 44. SIDE FRAMES AND CELL BANDS ASSEMBLY
FIGS. 45-46. DETAILS OF STRUT AND FRAME CORNER

the struts a trifle long so that they will bow slightly to stretch and hold the cell bands taut. Slip the struts close to the frame cross sticks, and lash them to these sticks. Fasten the cell bands with small tacks or cement.

THE BRIDLE is of the two-point type, shown in Fig. 41. Make the loop about 36 inches long. Join the flying line securely so that it cannot slip. Use a stout

wrapping twine or mason's twine for flying the box kite.

POPULAR KITE CONTEST EVENTS

A store window stocked with kites early in the Spring is certain to open the season of kite flying, but the home-made models that make their appearance almost simultaneously generally give better performance. Why? Because it takes as much gumption to fly a kite as it takes to make one, and the fellow who builds a good model usually has the knack of flying it. To encourage the flying of home-made models, tournament rules exclude models that the contestants have not made themselves.

CONTEST EVENTS that have proved popular in tournaments held the country over by schools, playgrounds and other community organizations, include the following: 100 Yard Dash, Pulling Contest, Altitude Contest, Duration Contest, Crossing the Lake Contest, Messenger Contest, Aerial Battle Contest, Kite Building Contest, Novelty Contest and Beauty Contest.

THE 100 YARD DASH is a contest in winding in a kite with 100 yards of kite line. Contestants must be spread out over the flying field to avoid entanglement of flying lines, and there must be elimination heats and finals when the list is large.

THE PULLING CONTEST is to determine the strongest pulling kite. It requires the use of a spring balance. The spring balance is hooked to a loop in the flying line, and the pull in pounds is recorded. Three or

more readings should be made and averaged for the final score.

THE ALTITUDE CONTEST winner is determined by the amount of flying line payed out.

THE DURATION CONTEST winner is determined by the length of time the kite remains in the air. Inasmuch as kites may be kept aloft for twenty-four hours or longer, under favorable air conditions, there must be a checking of lines at intervals, so long as a kite remains in the air.

CROSSING THE LAKE CONTEST. This is a variation of the duration contest, held annually by the Chicago Parks Recreation Department on the shore of Lake Michigan. Each kite line is hitched to a *water drag*, which is a frame like that of an ice yacht with a reach of 7 or 8 feet and a cross beam of about 3 feet long. A corked bottle, sealed with paraffin, is fastened to the drag. In the bottle is placed a sheet of paper with name and address of flyer, point and date of launching, and a request that the finder report time and place of landing insofar as his data makes possible. A self addressed postcard or stamped envelope is also enclosed. Under favorable weather conditions, kites tow their drags to the opposite shore. The contest is more likely to be successful upon small lakes, two or three miles across. Of course it can be held only when the wind is offshore, and weather conditions will determine the date.

THE MESSENGER CONTEST requires that an equal length of line be used by contestants. The paper message slipped over the flying line that runs up

the line and reaches the kite first is winner. Field glasses are required to judge this contest.

THE AERIAL BATTLE CONTEST goes to the flyer whose kite remains aloft longest. Contestants are allowed to provide their flying lines with cutting devices, such as knives, razor blades and ground glass mixed with glue, and the stunt is for a contestant to cross his line with his opponents' lines one by one, and bring the kites down by severing the lines with his cutting device.

THE KITE BUILDING CONTEST may be used to determine the speediest builder. The winner must build and fly his kite to the judges' satisfaction.

THE NOVELTY CONTEST is for original and unique designs in kites, such as turtle kites, frog kites, butterfly kites, man kites and comics.

THE BEAUTY CONTEST is for artistic designs in kites. Kites entered in this and the novelty contest must be judged before and during flight.

Chapter III

SIMPLE MODEL BOATS

A Model Yacht with Strap-Hinge Keel—A Model Motor Boat Without Power Plant—A Model Speed Boat With Rubber-Band Motor—A Model Patrol Boat with Rubber-Band Motor—A Model Tugboat Without Power Plant

THESE boats have been presented for my younger readers. If they do not interest you, turn the pages to the chapter on the 30-inch model yacht. Some of you older fellows will get a lot of fun building them for no other reason than to give them away. Since almost all of the materials needed can be picked up at home, the boats cost practically nothing to make, and you can knock them together quickly.

A MODEL YACHT WITH STRAP-HINGE KEEL

THE HULL of the model yacht shown in photograph Fig. 47 is to be cut from a 2-by-4 block of the length given in Fig. 53. No plan has been drawn to show the shaping because it is not supposed that you will put a great deal of time upon the work. You may shape the hull like that of one of the models upon following pages, making templets with which to gauge the carving, as described in Chapter V. But if you will simply point the bow and round the stern and bottom, it will be sufficient for this simple model.

Do the shaping with a drawknife or plane, finishing with a wood rasp and sandpaper. Or use a sharp jackknife and sandpaper, if your tools are limited.

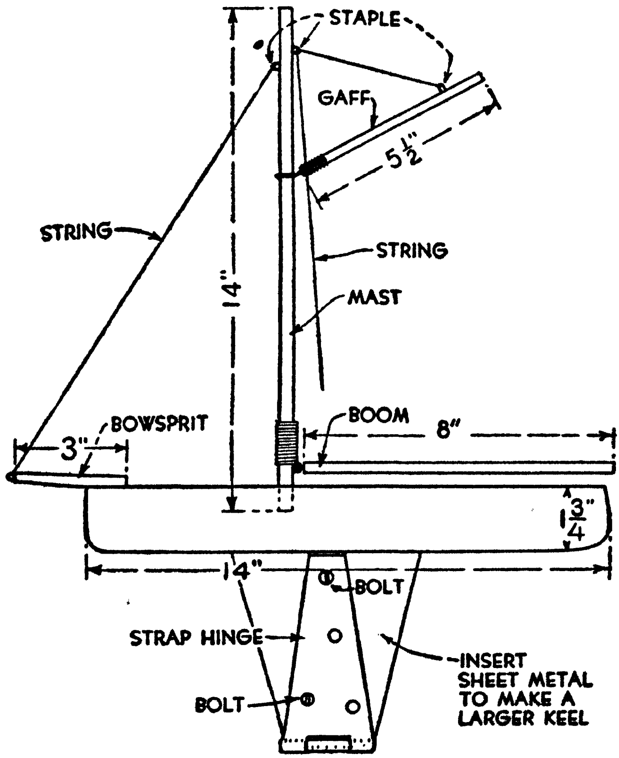


FIG. 53. DETAIL OF HULL AND RIGGING OF MODEL YACHT IN PHOTOGRAPH FIG. 47.

THE KEEL is a strap-hinge 6 inches long (Fig. 54). Bend over the tips of the hinge straps at right angles, as shown, and screw them to the center of the hull bottom. If you want a larger keel, cut a piece

of sheet metal to fit between the straps and fasten it with short stove bolts, as suggested in Fig. 53.

THE MAST, BOOM AND GAFF are shown in Fig. 53. Cut them from dowel sticks or flag sticks or whittle them out of sticks. Make the mast of a stick 3/8 inch in diameter, the boom and gaff of sticks 1/4 inch in diameter. Bore a hole in the hull and drive the

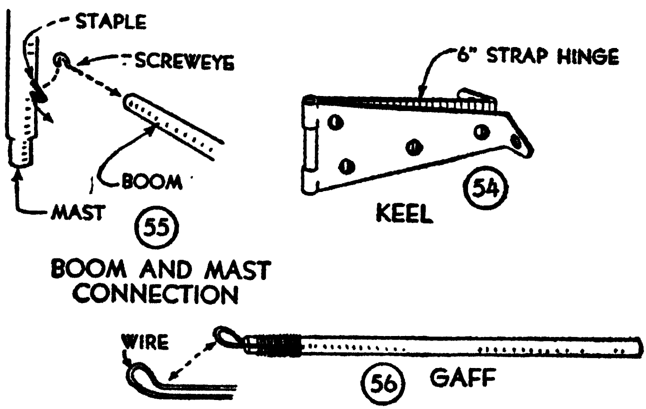


FIG. 54. STRAP-HINGE KEEL
FIGS. 55-56. SPAR DETAILS

mast into it. Join the boom to the mast 1/2 inch above the deck with a staple and screweye (Fig. 55), and lash a wire loop to the gaff end as shown in Fig. 56, to fit over the mast.

THE BOWSPRIT, shown in Fig. 53, is tapered from end to end and flattened to fit the deck. Brad it to the deck.

MAKE SAILS OF MUSLIN. Take the dimensions from the rigging detail (Fig. 53). Ask Mother to hem the edges of the sails to keep them from raveling.

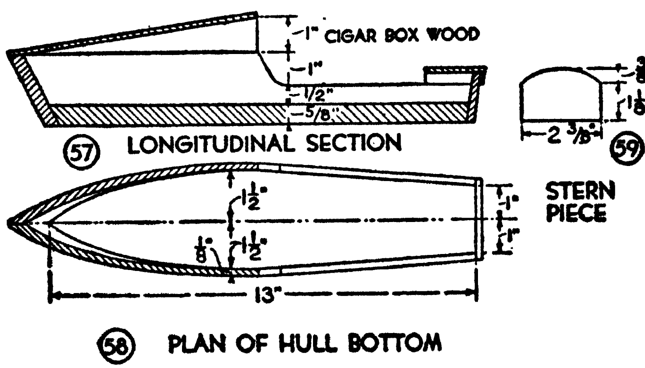
Sew fancywork rings to the mast edge, or *luff*, of the mainsail for mast rings. Baste the head of the sail to the gaff and the foot to the boom.

Complete the rigging with string, as shown in Figs. 47 and 53.

Finish the hull with paint. Varnish the mast, boom and gaff.

A MODEL MOTOR BOAT WITHOUT POWER PLANT

Although the model shown in Fig. 48 hasn't a motor, you can easily install either a clockwork outboard motor or a rubber-band motor.



Figs. 57-59. Details of model motor boat in photograph Fig. 48

The hull is built up as shown in the longitudinal section (Fig. 57) and the plan (Fig. 58), with a bottom block ⅝ inch thick and sides of cigar-box wood, which is about ⅛ inch thick.

The cabin deck is a piece of cigar-box wood. Wet

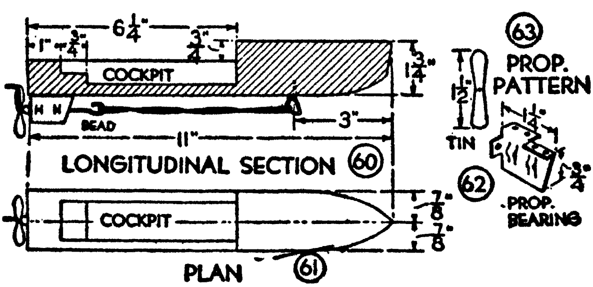
it before bending it into shape. Fit a piece of wood in the after end of the cabin.

The cabin portholes are framed with brass eyelets or grommets. You can get these from a shoemaker. Drill holes in the cabin walls with equal spacing and glue the grommets into them.

Finish the motor boat with a coat of boiled linseed oil. Rub the oil into the cigar-box wood. Then apply a coat or two of spar varnish and the cigar-box wood will look like the mahogany of a custom-built cruiser.

A MODEL SPEED BOAT WITH RUBBER-BAND MOTOR

The little speed boat in photograph Fig. 49 is to be whittled out of a solid block of pine 1¾ inches square and 11 inches long (Figs. 60 and 61).



Figs. 60-63. Details of model speed boat in photograph Fig. 49

Shape the hull as shown with pointed bow and rounded bottom.

Lay out the cockpit by the dimensions in Fig. 60. Cut away the block above the deck line with a saw. Then whet your knife blade to a keen edge and hol-

low out the cockpit. Form a stern seat as shown. A chisel will be helpful in this work, especially in the cleaning up of surfaces.

FINISHING. Smooth the surfaces with sandpaper, then give them a coat of mahogany stain and one or two coats of spar varnish, or, for a snappier finish, two coats of bright red automobile enamel.

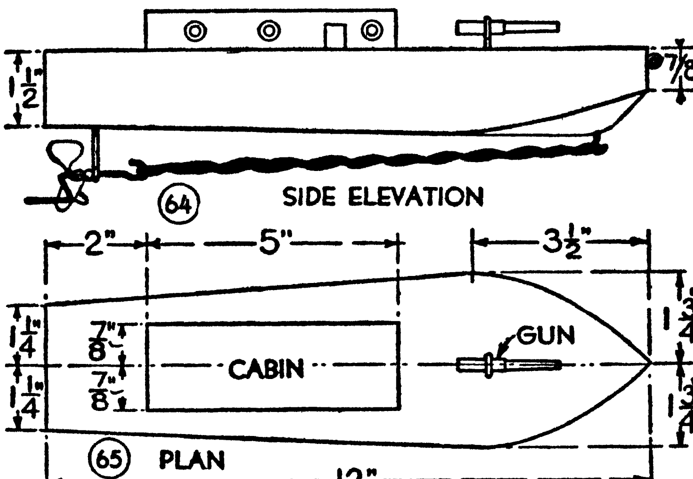
THE MOTOR AND PROPELLER are shown in Fig. 60. For the front *motor hook*, drive a finishing nail into the hull bottom, and bend over its end with pliers, as shown. Cut the *propeller bearing* out of tin by the pattern of Fig. 62. Notice the lug on the end of the bearing, drilled for the propeller shaft to run through, and the two lugs on the upper edge, bent over in opposite directions, and drilled for screws for fastening to the hull bottom. Also, notice how the tin is slotted and bent to form sleeves to support the propeller shaft.

Cut the *propeller* out of tin by the pattern of Fig. 63, and twist the blades to angles of 45 degrees. Bend the *shaft* out of a piece of stiff wire, with a hook on one end and a crank handle on the other. Solder the propeller to the shaft. Figure 60 shows the motor assembly. Place a glass bead, or several model airplane washers between the propeller and the bearing, as shown in Fig. 60. For the motor, use a heavy rubber band, or model airplane rubber.

A MODEL PATROL BOAT WITH RUBBER-BAND MOTOR

THE HULL of the model shown in photograph Fig. 50 requires a 2-by-4 block of white pine. Dimensions

for shaping it are given in Figs. 64 and 65. Lay out the streamlines as shown. First, draw a center line on opposite faces of the block. Then draw the line of one side, make a tracing of it, and transfer the tracing to the opposite side of the center line, and to the opposite face of the block. This is the way to get a symmetrical layout.



FIGS. 64-65. ELEVATION AND PLAN OF MODEL PATROL BOAT IN PHOTOGRAPH FIG. 50

Saw out the block close to the outlines, then finish the shaping with a plane. Notice that there is a taper of ¼ inch to the bottom between bow and stern.

THE CABIN requires a block of the size shown in Fig. 66. Saw a slot in the lower edge of the block for doorways, and drill three holes in each side for brass grommet *portholes*. Nail the cabin block to the hull in the position shown in Fig. 65.

THE DECK GUN. Screw a ¼-inch screw-eye into the forward deck for the gun mount. Shape the gun out of a dowel stick or pencil, as shown in Fig. 67, to fit snugly in the eye.

FINISH THE PATROL BOAT a battleship gray, or, if you want a brighter finish, paint the hull green and the cabin red. Two coats of oil paint and a coat of

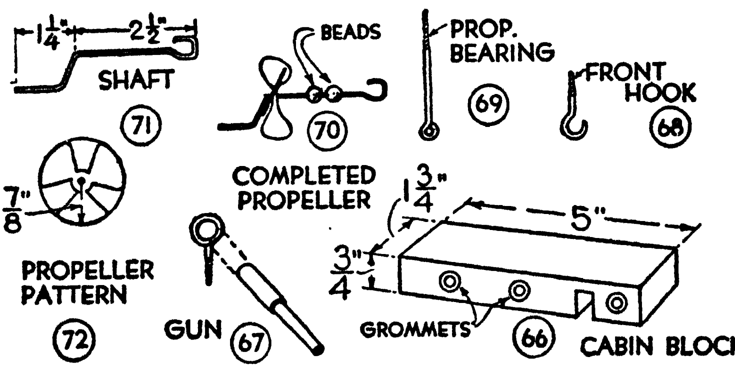


FIG. 66. DETAIL OF CABIN
FIG. 67. DETAIL OF GUN
FIGS. 68-72. DETAILS OF POWER PLANT

spar varnish, or two coats of automobile enamel, will make a first class job.

THE POWER PLANT is shown in Fig. 64 and detailed in Figs. 68 to 72. Use a brass cup hook for the front *motor hook* (Fig. 68). Make the *propeller bearing* out of a 2-inch brass hook, shaping the hook end into a small eye by hammering it over a piece of wire of small diameter (Fig. 69).

Figure 70 shows the *propeller* and *shaft*. Lay out the three-bladed propeller by the pattern in Fig. 72, upon a piece of brass or tin. Cut it out and twist

the blades to an angle of 45 degrees. Bend a shaft out of stiff wire, of the shape and size shown in Fig. 71, slip the propeller over it and solder it to the wire at the crank end. Before shaping the hooked end, slip it through one or two glass beads, or model airplane washers, and through the end of the bearing.

For the *motor* use six strands of model-airplane rubber.

A MODEL TUGBOAT WITHOUT POWER PLANT

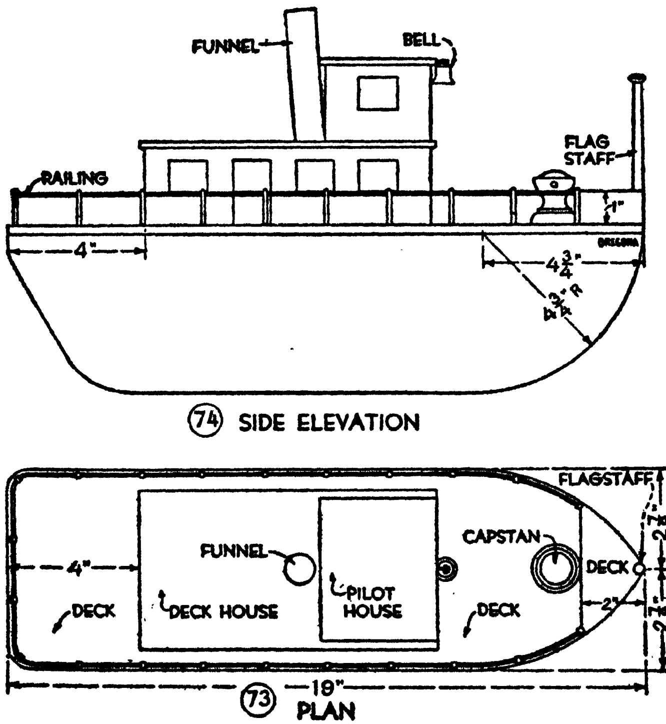
The model tugboat shown in photograph Fig. 51 has no power plant, but you can add one if you want to. It will be a simple matter to install a rubber-band motor and propeller like that used for the patrol boat, or to install a toy electric motor and dry cells. There is plenty of room in the hull for a motor and dry cells.

The hull of the model in the photograph was carved out of a solid block of cedar. Its dimensions are given on the plan (Fig. 73) and the side elevation (Fig. 74). You may not be able to get a block of the size required. In that case you will have to build one up of several layers, or *lifts*, as shown in Fig. 76. This is the usual way to build a hull, known as the bread-and-butter method. Three pieces of 2-by-6 19 inches long will make the right sized block.

With the hull block in hand, scribe a center line along the top and bottom faces, and across the ends. Then lay out the deck plan (Fig. 73) upon the top face. One templet will be sufficient for a gauge for

carving the block. Lay it out by the dimensions given on the front elevation (Fig. 75).

IN SHAPING THE HULL, saw out the block along the deck lines, then work up the sides and finally round



FIGS. 73-74. PLAN AND SIDE ELEVATION OF MODEL TUGBOAT IN PHOTOGRAPH FIG. 51

off the bow and stern. A draw knife, a plane, a wood rasp and several grades of sandpaper will do the trick.

HOLLOWING. When you have shaped the outside of the hull, turn your attention to the inside. As this

is a large block it is important to cut away as much of the inside as possible to reduce weight. A gouge is best for this work, but a chisel may be substituted.

COVER THE DECK with a piece of ¼-inch board. Fasten this to the hull with small brass screws or escutcheon nails.

THE DECK HOUSE AND PILOT HOUSE should be built of thin wood. Wood from cigar boxes or berry

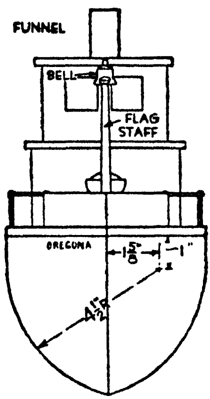


FIG. 75. FRONT ELEVATION OF MODEL TUGBOAT

crates will do. Figure 77 shows patterns for the walls of the deck house, and Fig. 78 shows patterns for the walls of the pilot house. Be careful to get the corners of the parts square in laying them out. Saw out the door and window openings with a coping saw. Bore a hole through each window outline to admit the coping-saw blade.

Assemble the houses with glue and brads. Then cut deck pieces of the right size to project over the walls as shown. Fasten the deck house to the deck

and fasten the pilot house to the deck house, in the positions shown in Fig. 73.

THE FORWARD DECK requires a block of the size marked in Figs. 73 and 74, cut to the lines of the hull. Glue and nail it in place.

MAKE THE FUNNEL of a piece of rug pole or other pole (Fig. 79) and mount it back of the pilot house (Figs. 73 and 74).

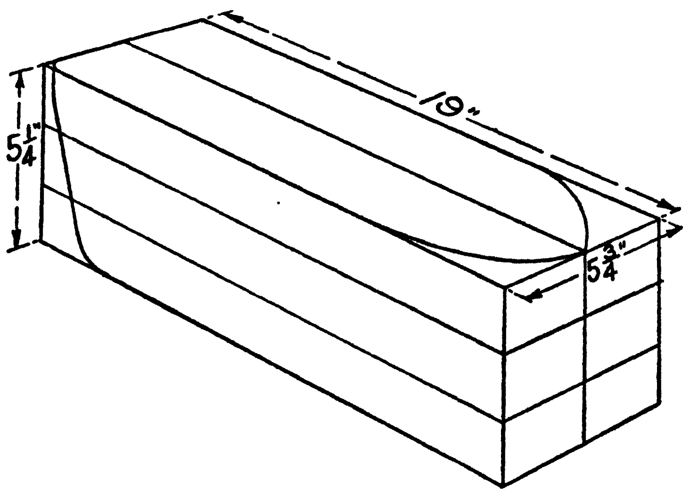


FIG. 76. HULL BLOCK READY FOR CARVING

THE CAPSTAN may be turned on a lathe, but it is easier to make it of a wooden base knob and a button mold (Fig. 80). Saw off the top of the knob, indicated by dotted lines, and glue the button mold in its place. Screw the capstan to the deck aft of the forward deck (Fig. 73).

THE DECK RAILING requires twenty-two cotter pins about 1¼ inches long for *stanchions* and wire of No.

12 gauge (Fig. 81). Drill holes in the deck a trifle larger than the cotter pins, and drive in the pins to a depth of ½ inch, then bend the wire and run it through the eyes of the cotterpins.

THE FLAGSTAFF is a 3½-inch length of dowel stick with two small button molds fastened to its top.

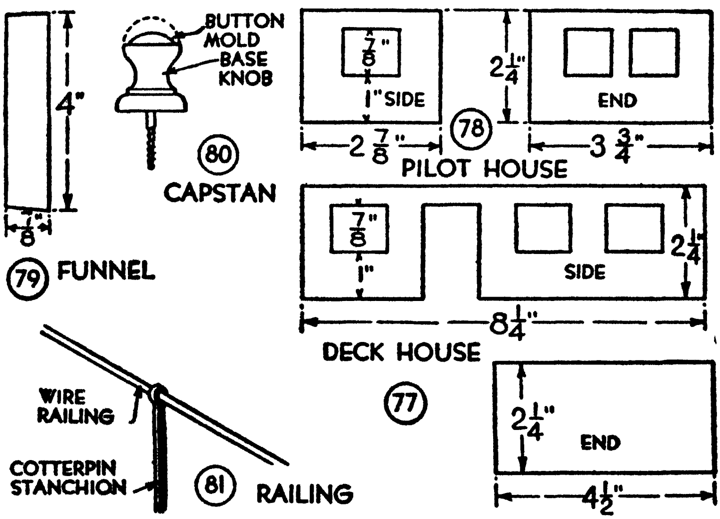


FIG. 77. WALLS OF DECK HOUSE FIG. 79. FUNNEL
FIG. 78. WALLS OF PILOT HOUSE FIG. 80. CAPSTAN
FIG. 81. DETAIL OF RAILING

THE SHIP'S BELL, suspended from the deck of the pilot house, is a small novelty bell.

FINISHING. There is quite a bit of work to the finishing of the tugboat. First sandpaper all surfaces smooth. Then get some gray oil paint and give the hull and the walls of the houses two coats. Shellac and varnish the decks. Finish the railings, capstan and bell with black enamel.

Chapter IV

A MODEL AIRCRAFT CARRIER

The Aircraft Carrier Floats—The Hull and Main Deck—The Superstructure—Deck Railings—Finishing the Model—Anchoring the Airplane Squadron

THIS is a new idea in model boats. It is not presented as a replica of the U.S.S. Saratoga and Lexington, among the first of this type of craft, but it has their general lines. The small toy airplanes of iron or celluloid sold in dime stores are of the right size for its airplane squadron and its deck runway accommodates eight or more.

THE AIRCRAFT CARRIER FLOATS

As you will see by photograph Fig. 52, the model airplane carrier floats. It has been designed without a power plant with the intention that it should be towed by a string attached to its bow. However, it is possible to install a motor and that is a development for you to work out.

THE HULL AND MAIN DECK

Figure 82 shows a detail of the completed carrier. A dimensioned plan of the hull blocks is given in Fig. 83 and one of the main deck is given in Fig. 84.

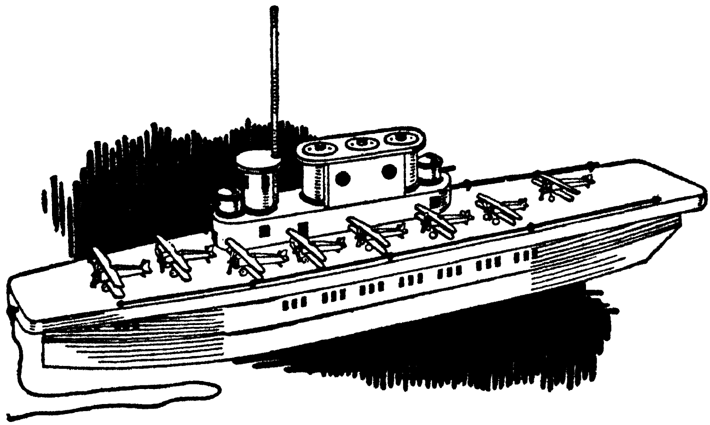
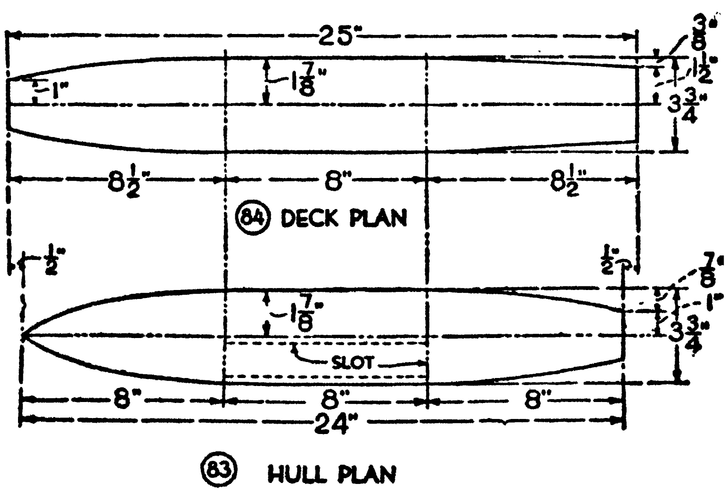


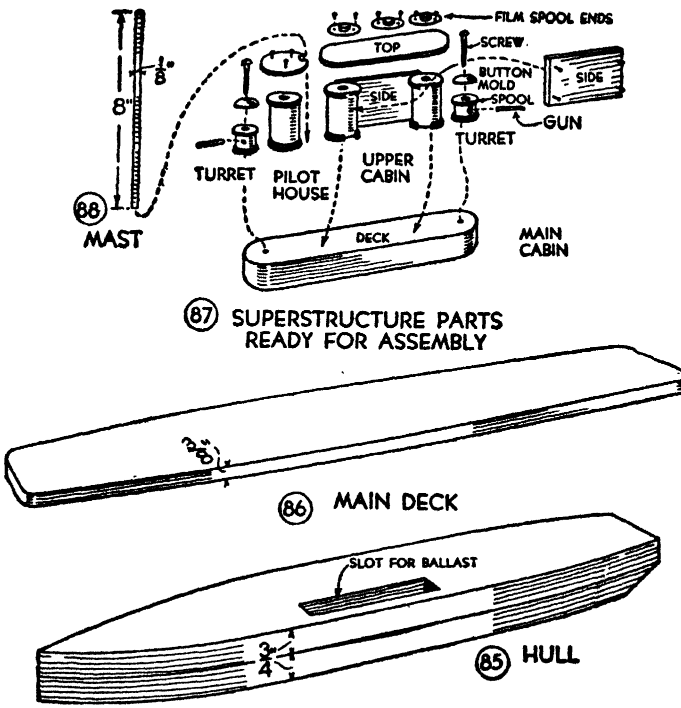
FIG. 82. MODEL AIRCRAFT CARRIER IN PHOTOGRAPH FIG. 52



FIGS. 83-84. HULL AND DECK PLANS

LAY OUT THE HULL BLOCKS upon a board ¾ inch thick, and saw them out and finish their edges with a plane and sandpaper.

BALLAST. The port sides of the hull must be ballasted to balance the weight of the starboard superstructure. To provide for the ballast, slot the upper



FIGS. 85-86. HULL AND DECK READY FOR ASSEMBLY
FIG. 87. SUPERSTRUCTURE PARTS READY FOR ASSEMBLY
FIG. 88. MAST

block as shown in Figs. 83 and 85. Glue the blocks together with waterproof glue, and fill the slot with melted lead or sand. About eight ounces are required to offset the weight of the superstructure.

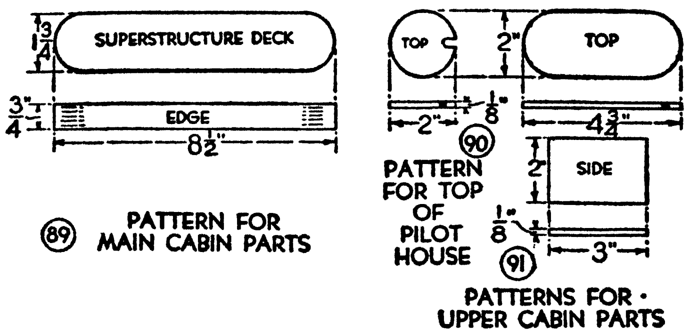
LAY OUT THE MAIN DECK upon a board 3/8 inch thick,

following the dimensions on the plan (Fig. 84). Saw out the deck piece, and plane up its edges (Fig. 86). Glue and nail it to the hull so that there are ½-inch projections at the bow and stern.

THE SUPERSTRUCTURE

Figure 87 shows the units of the superstructure ready for assembly.

THE MAIN CABIN requires a block of the dimensions given in Fig. 89. Round the ends as shown.



FIGS. 89-91. PATTERNS FOR SUPERSTRUCTURE

THE GUN TURRETS, mounted at each end of the cabin deck, are small silk-thread spools with button mold tops (Fig. 87). Drill a hole in the side of each spool and glue a piece of match stick into it for a gun. Glue the button molds to the spools and pivot the turrets to the deck with round-headed screws.

THE PILOT HOUSE is a spool 1⅛ inches in diameter and 2 inches long (Fig. 87) with a top cut out of cigar-box wood (Fig. 90). Notch the edge of the roof for a recess for the mast. Brad the roof to

the spool and mount aft the forward gun turret.

MAKE THE MAST of a piece of dowel stick (Fig. 88) and tack it to the pilot house.

THE UPPER CABIN requires two spools of the size of that used for the pilot house and two sides and a top of cigar-box wood (Fig. 87). Patterns for the sides and top are given in Fig. 90. Trim off the spool flanges so that the sides will rest against the spools. Brad the sides and top to the spools, as indicated in Fig. 87. Mount the cabin forward of the after gun turret.

THE SMOKE FUNNELS project through the upper cabin deck. Make them of the ends of wooden film spools bradded to the deck.

MOUNT THE SUPERSTRUCTURE upon the main deck flush with the starboard side and 8 inches from the bow.

DECK RAILINGS

Make deck railings of heavy wire, with small cotterpins for stanchions. A detail of such a railing is shown in Fig. 81 of Chapter III. Drill deep enough holes for the cotterpins so that you can drive them down to bring the railing close to the deck.

FINISHING THE MODEL

With the assembly completed, sandpaper all surfaces. Then shellac and varnish the decks and mast, and paint all other surfaces white or battleship gray,

except those of the funnels and deck railings, which should be black. Outline port and doorways with a ruler and pencil and fill in with black paint.

ANCHORING THE AIRPLANE SQUADRON

Fasten rubber bands to the deck with double-pointed tacks to form loops for holding the planes in position.

Do not place all of the planes upon the port side as that would overbalance the hull. Fasten several on the starboard side of the forward and after decks. If the planes are to be fastened permanently, however, you can provide for counterbalancing by using less lead ballast in the ballast slot of the hull.

Chapter V

THE SEA GULL

The Bread-and-Butter Hull—The Keel—A Cradle for the Model —The Deck—The Spars, Fittings and Stays—The Rudder and Tiller—An Automatic Rudder Control—The Jib and Mainsail— Finishing the Model—Grease in the Rudder Post Port—Rules for Model Yacht Regattas

When you have served your apprenticeship building simple boat models you will be ambitious to tackle something of a more pretentious design and dependable performance, and the Sea Gull in photograph Fig. 92 is presented as the model to satisfy that ambition. This clean-cut stream-lined racing sloop with well balanced rig has a hull of 30 inches and a beam of 6 inches. Her mast is 44 inches and her sail area is 460 square inches.

THE BREAD-AND-BUTTER HULL

Figure 93 shows a plan of the hull and Fig. 94 an elevation. As you will note the bread-and-butter or lift method of building up the hull has been used, with seven lifts of ¾-inch stock. This method is preferable to that of carving the hull out of a solid block, not only because ¾-inch stock is easier to obtain but also because it can be selected clear. A solid block may have a knot or two and probably checks and other defects. Each lift can be sawed

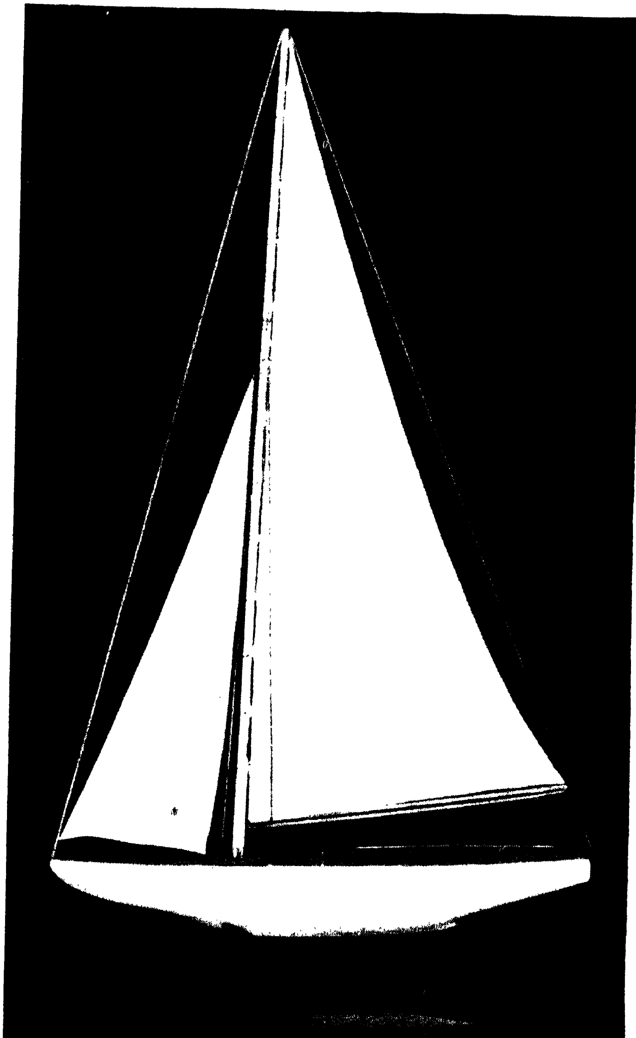
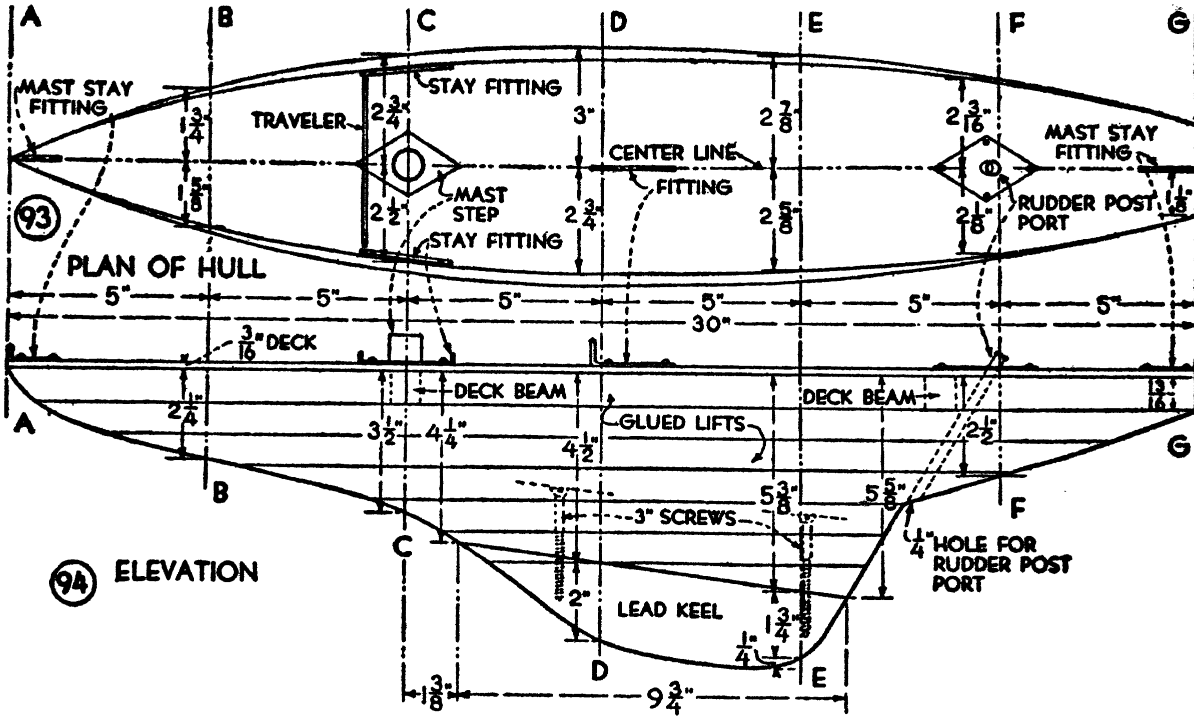


FIG. 92. THE SEA GULL—A NICELY DESIGNED MODEL RACING SLOOP WITH A WELL BALANCED RIG



FIGS. 93-94. PLAN AND ELEVATION OF HULL

inside and out on the scroll saw, then all glued up as shown in Fig. 95. This saves a lot of work with gouge and chisel and facilitates the carving.

White pine is generally preferred for model making and you can get it at any lumber yard. A 6-inch board is a trifle too narrow for the top lifts of the hull but all right for the others.

Make full-size working drawings of the plan and elevation of the hull (Figs. 93 and 94). By drawing the station lines A to G, then laying off the given

Fig. 95. THE BREAD-AND-BUTTER OR LIFT METHOD OF BUILDING UP THE HULL FOR CARVING

dimensions on these lines, it is a simple matter to draw the curved lines of the hull through the points. Also make a full-size layout of Fig. 96 which shows cross-sections at stations A to G.

Marking and Cutting the Lifts. With the full-size drawings in hand, it is no trick to mark the lines of the seven lifts upon your white-pine stock. And to saw out the lifts is but a few minutes' work.

Gluing. Use casein glue for gluing. After fitting together the coated lifts apply pressure until the glue has set. Figure 97 shows a gluing jig. It con-

sists of two boards with carriage bolts run through the corners. Cabinetmaker's clamps will serve the purpose.

Templets. While the glue is setting, prepare templets with which to gauge the outside carving. Cut

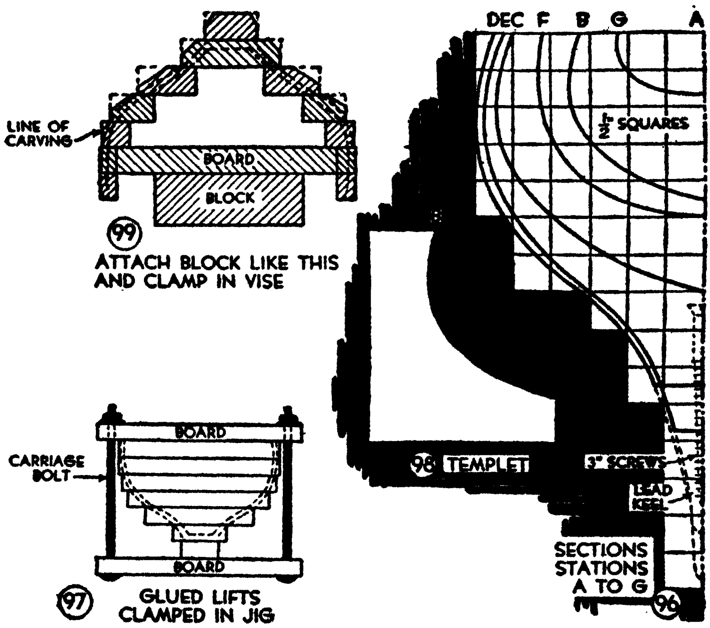


Fig. 96. sections through hull at stations A-G
Fig. 97. templet for gauging the carving
Fig. 98. glued lifts
Fig. 99. hull vise block for outside carving

these out of cardboard or sheet metal. Make one for each station from B to G. Figure 98 shows the templet to use at station B. Take the templet profiles from the full-size cross sections made from Fig. 96.

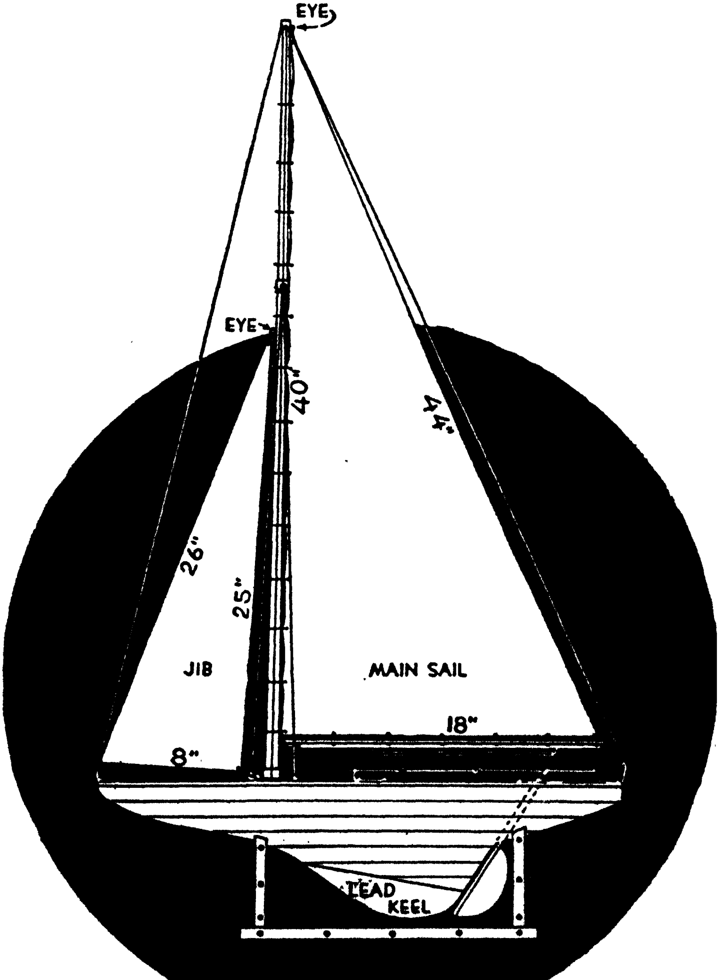


FIG. 100. DETAIL OF HULL, RIGGING AND CRADLE

To support the hull while carving fit a board inside it as shown in Fig. 99, and fasten a block to the board to grip in the vise.

Shape the hull with a draw knife or draw shave and plane. With careful cutting and frequent application of the templets, the most inexperienced craftsman cannot go wrong in this part of the work. A wood rasp and several grades of sandpaper will true up and smooth the surfaces.

Shape the inside next, reducing the thickness of the sides as indicated by dotted lines in Fig. 99. Prepare a jig to support the hull during this operation.

THE KEEL

A pattern and a mold are necessary for the lead keel. Shape a wooden pattern of the form and size shown in Figs. 94 and 96. Make a plaster-of-Paris mold from the pattern. Pour melted lead into the mold and smooth up the casting with a file and sandpaper. Fasten the keel to the hull with screws 3 inches long, driven through the hull into it as indicated in Figs. 94 and 96.

A CRADLE FOR THE MODEL

It is well at this point to build a cradle like that in Fig. 100, to support the finished hull. Figure 101 gives the dimensions for the bow and stern upright blocks. Cut the base board of the given width and 16½ inches long. If you can cut the parts out of mahogany, do so. If not, use pine and stain it ma-

hogany. It will set off the cradle to trim its edges as shown with strips of polished and lacquered brass

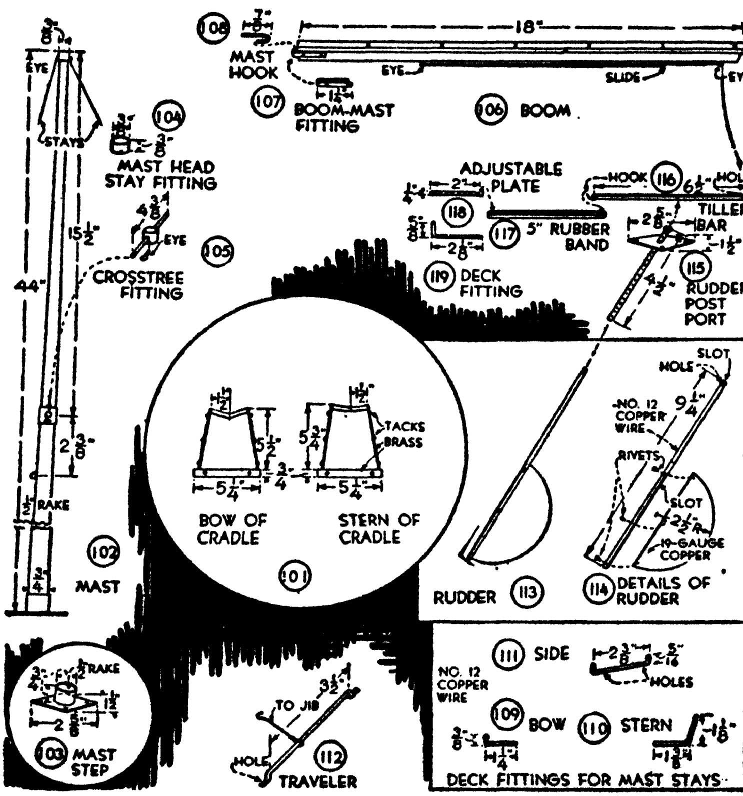


FIG. 101. DETAILS OF CRADLE
FIGS. 102-108. MAST, BOOM AND FITTINGS
FIGS. 109-111. DECK FITTINGS FOR MAST STAYS
FIG. 112. JIB TRAVELER
FIGS. 113-114. DETAILS OF RUDDER
FIGS. 115-119. DETAILS OF RUDDER POST PORT, TILLER BAR AND FITTINGS

fastened with brass escutcheon nails or round-headed brass screws, but this trim is not essential.

THE DECK

Mahogany makes the most attractive deck, but white pine finished with clear lacquer or spar varnish also looks well. Use stock 1/8 inch thick. Scribe knife lines 1/8 inch apart to indicate planking.

THE SPARS, FITTINGS AND STAYS

THE MAST is shown in detail in Fig. 102. Taper it in a lathe from a diameter of 3/4 inch at the base to 3/8 inch at the top.

MAKE THE MAST STEP of a piece of 3/4-inch brass or copper tubing soldered to a diamond-shaped piece of No. 19-gauge sheet brass or copper, as shown in Fig. 103. File off the bottom of the piece of tubing so that the step will give the mast a 1/2-inch rake.

MAST FITTINGS. Make the *mast-head stay fitting* (Fig. 104) and the crosstree fitting (Fig. 105) of brass or copper tubing, to fit the mast. Make the *crosstree* of No. 12 brass or copper wire, with ends slotted for stays, and drill a hole through the mast and fitting to drive it through.

THE BOOM has a "T" cross section. Figure 106 gives its dimensions.

BOOM FITTINGS. Make a metal *loop* for the mast end of the boom (Fig. 107) and fasten it to the boom with brass nails. Shape a *hook* (Fig. 108) to engage the boom loop and drive it into a hole drilled through the mast.

Deck Fittings. Prepare a *bow fitting* like that in Fig. 109, a *stern fitting* like that in Fig. 110 and two side fittings like that in Fig. 111. The easiest way to shape these is to flatten pieces of No. 12 brass or copper wire with a hammer, bend the ends as shown, and drill for screws and stay connections. Fasten the fittings to the deck with round-headed brass screws.

The jib is provided with a *traveler* of the form shown in Fig. 112. Make it also of No. 12 wire, flattened and drilled for screws. Fasten the fittings to the deck in the positions shown in Fig. 93 with round-headed brass screws.

Mast Stays. Use brass or copper wire for stays, fasten them to the mast and deck fittings and twist their ends to make them taut.

THE RUDDER AND TILLER

Figures 113 and 114 show the *rudder* and *post.* Cut the rudder out of No. 19-gauge sheet brass or copper, the post out of No. 12 brass or copper wire. Slot the post to admit the rudder and rivet the rudder in the slot. Slot the post top for the tiller bar, and drill for a rivet. Make the *rudder-post-port* of $\frac{5}{16}$-inch brass or copper tubing (Fig. 115). Turn over the upper end as shown. Cut a brass or copper *port deck fitting* of the size shown, drill it to receive the port, also for screws, and solder the tubing to it.

The tiller bar is a flattened piece of brass or copper wire (Fig. 116). Drill holes at its center and ends. Slip it into the rudder post slot and rivet it

later when you are ready to complete the rudder assembly.

AN AUTOMATIC RUDDER CONTROL

The tiller is rigged for automatic control of the rudder. Its after end is connected to the boom. Its forward end has a wire *hook* that engages a 5-inch *rubber band.* (Fig. 117). The rubber band in turn engages a *hook* attached to an *adjustable plate* (Fig. 118) and the plate hooks over a *deck fitting* (Fig. 119). Make the adjustable plate $\frac{3}{16}$ inch wide by the given length and drill $\frac{1}{8}$-inch holes through it for the post of the deck fitting to slip through.

The rubber band and plate provide for the adjustment of tension on the forward end of the tiller bar. Two brass screw eyes in the under side of the boom, with fishing line run through them, and a metal slide attached to one end of the line, provide for the adjustment of the boom. When the boom swings to one side, this rig pulls the stern of the tiller in that direction, the rudder is turned and the yacht is held to her course.

THE JIB AND MAINSAIL

Figure 100 shows measurements for the jib and mainsail. Make them of nainsook, with selvage along the long edge. Hem the cut edges. Set in tiny *eyelets* along the luff and foot of the mainsail for the *mast rings* and the *boom lashing.* Make rings of copper or brass wire. Instead of lashing the foot to

the boom in the regular manner, run brass or copper wires through the eyelets and through holes drilled through the boom, then clinch the wire ends on the under side of the boom.

FINISHING THE MODEL

With the model completely rigged, dismantle it for finishing. The secret of a nicely finished hull is to apply a number of coats of thinned paint or lacquer instead of using it of the consistency it comes in the can.

SANDING. Do not spare sanding. Rub down all surfaces with No. 0 sandpaper, then with No. 00. After sanding, wipe the surfaces with a cloth moistened with turpentine to remove grit and dust.

IF YOU USE PAINT buy white lead ground in oil. Thin it with turpentine to the consistency of cream. Apply three coats, and after each has dried, sand lightly with No. 00 sandpaper. If the hull is to be white, add a fourth and a fifth coat, and rub down the last coat with powdered rottenstone to produce an eggshell finish.

IF YOU USE COLOR, select a tube of oil color at the paint store and mix it with white lead. Apply two coats over the three coats of white.

IF YOU PREFER LACQUER, thin it with lacquer thinner and apply at least five coats, sanding lightly between coats. A spraying outfit will simplify the work.

IF THE DECK IS MAHOGANY, stain it with light mahogany stain, then apply three coats of spar varnish

or clear lacquer, sanding lightly between coats and rubbing down the final coat with rottenstone.

FINISH THE SPARS with three coats of spar varnish or clear lacquer.

BURNISH METAL FITTINGS and lacquer them.

GREASE IN THE RUDDER POST PORT

When you have rigged the Sea Gull and completed adjustments, pack the rudder post port with vaseline or motor grease.

RULES FOR MODEL YACHT REGATTAS

The same organization that has promoted model airplane and kite tournaments in your town may see fit to conduct an annual Model Yacht Regatta. Therefore, the following rules from the "Racing Rules for Pond Sailing," laid down by the International Yacht Racing Association are presented:

DEFINITIONS

SKIPPER. The person sailing the yacht, including his assistant.

COMPETITOR. A yacht forming part of a pair.

PAIR. Two or more yachts drawn to sail together in a heat.

BOARD. A course in one direction of the lake.

HEAT. Two or more boards in which the same pairs sail.

SHORE. The sides of the lake other than the starting line and the goal.

OBSTRUCTION. Anything (excluding weed) that may stop a yacht other than its competitor or the shore, including other yachts sailing in the same board.

FOUL. When a yacht colliding with a competitor or obstruction is hung up, turned off her course, or has any of her gear disarranged so as to affect her chance of winning a board.

OFFICER OF THE DAY. The officer appointed to take charge of the racing and act as referee.

COMPLETION OF A BOARD. A yacht shall be deemed to have completed a board as soon as any part of her hull or gear has passed the winning line.

When races are held on enclosed waters where yachts can be handled from the shore, the following rules shall apply:

READINESS FOR PUNCTUAL START. All competing yachts are to be out of the water and at the starting place at least ten minutes prior to the advertised time for the start.

METHOD OF SAILING ON ENCLOSED WATERS. When yachts are handled from the shore all events are to be sailed on the tournament system.

SCORING. In sailing races the scores shall be counted in points: For a win to windward, 3 points are to be awarded; for a win to leeward, 2 points; for a win in reaching winds, 2 points.

In the event of a dead heat the board is to be resailed.

Should the leading yachts tie with equal points at the end of a race, the yacht having the greater number of windward boards to her credit shall be declared the winner; but if there still be a tie the yachts in question are to sail one windward board to decide (in reaching winds a board in the direction in which the race was started).

STATIONS AND STARTING. Stations (weather and leeward berths) shall be drawn for before starting, and competitors must *both* start on the same tack (with sails full and drawing) and from the positions (or starting marks) duly determined by the starter. The starting marks shall be not less than three yards apart.

PROPULSION. Skippers shall be allowed to push off their yachts at the start only by hand or by pole, but at no other time during a board may yachts be propelled otherwise than by the action of the wind, unless the yacht gets aground, when she may be pushed off. Poles to be of uniform length, but not longer than is customary or necessary on the particular water.

ENTERING THE WATER. A skipper shall not enter the water to turn, retrim or start a yacht, except at waters where it is customary to use waders or water boots; but in no case shall a pole be used in conjunction with waders or water boots.

HANDLING YACHTS. Whenever a yacht comes to shore she must either: (a) be tacked, or (b) be retrimmed.

For (a) in *windward boards* yachts shall be turned fairly about by the skipper taking a firm stand and (1) turning the yacht off by placing the stick or pole against the lee bow, and (2) he may also steady her around the pole against the lee side of the counter as she sails out. In any case her head-sail must fairly and definitely fill on the offshore tack before she leaves her skipper's control. Failure to do this shall entail disqualification for the board. No other part of the yacht, sails, or gear may be touched, unless to readjust her trim or to avoid an obstruction. When, and if, a retrim has been effected, the model shall be put off by hand only. A yacht put off on the "guy" and failing to "break tack" and returning to the shore from which she was put off, must be retrimmed.

NOTE. Failure to break tack occurs when a yacht has been correctly turned (with head-sails filled on the new tack) and she returns to the same shore on the same tack, *i.e.*, not having broken tack by the action of the guy.

(A "retrim" is a readjustment of a yacht's sails, gear or rudder that will allow her to proceed fairly on her course toward the finishing line.)

For (b) in *leeward boards* (or *reaching*) the yacht shall be stopped, retrimmed, and restarted by hand every time she comes ashore.

The skippers must remain stationary whilst retrimming or turning the yacht, and the yacht must be *stopped* whilst altering trim.

Whenever a yacht is put about, or restarted after retrim, her way must not be accelerated.

The "guy" properly applied constitutes a retrim, but a jibe does not.

AVOIDING COLLISION. Tacking, guying, starting a yacht after a retrim, or after coming to shore foul, may not be done so as to involve the immediate risk of collision.

COLLISIONS AND FOULS. (a) If a competing pair foul within six yards (or a similar distance previously settled by the Officer of the Day) of the starting line, they shall be restarted from their original positions. Should the foul recur

the starter may order them to start further apart, or to change positions.

(b) If a competing pair foul outside the distance mentioned above, the board shall be resailed on the order of the Officer of the Day, except as provided in Rules 12 and 13 (c), (d).

(c) If one of a pair fouls an obstruction the board shall be resailed, unless the Officer of the Day is of the opinion that she had no chance of winning the board.

(d) Should two or more yachts come to shore foul (covering each other) that which is to windward has the right to be first restarted; but if either requires adjustment, then that which is first ready may be first restarted, in which case such yacht must restart from a position astern of the other. Neither may be advanced to effect a retrim.

Chapter VI

A SPRING OVERHAULING OF YOUR BIKE

Knock Down the Bike—Cleaning and Lubricating—Truing a Wheel—New Rims and Spokes—Care of Tires—Care of the Frame—Renewing the Frame Enamel—Refinishing Rims—Rejuvenating an Old Bike

A THOROUGH cleaning and greasing make a world of difference in the performance of a bicycle, and it should be looked upon as a necessary Spring job. Indeed, a complete overhauling, with replacement of worn or defective parts, a good pair of tires, and you are guaranteed a minimum of road trouble the remainder of the year.

If you have had much riding experience, I will grant you that you know a lot about reconditioning a bike, but after consulting with several bicycle mechanics and adding to my own knowledge of servicing a wheel, I am convinced that you, too, will learn something to your advantage from the following suggestions. Check, and if I am mistaken in this, you may rate yourself as a one hundred per cent mechanic.

KNOCK DOWN THE BIKE

For a thorough overhauling, it is necessary to dismantle the entire bicycle. Remove the wheels, the handle bars and the front fork, as shown in photo-

graph Fig. 120. Then invert the frame, resting it as in photograph Fig. 121, and remove the eccentric crank hanger. Place nuts and washers and other small parts in tin cans so that they will not be lost.

CLEANING AND LUBRICATING

Take down each wheel, and place the hub, cone and ball bearings in kerosene or benzene. Wipe clean, reassemble, and repack with a light grade of motor grease. In adjusting the hub cones, set them so that when the wheel is turned with the tire valve at one side, the weight of the valve and cap is sufficient to cause the wheel to turn until the valve is at the bottom.

With the hub packed with grease, no further lubrication is necessary for a long time. Hubs used to have oil cups, but these are no longer provided because grease lubrication is preferable to oil.

Clean all other bearings and repack with light grease.

Place the sprocket chain in kerosene or benzene, and brush it until it is clean. Lubricate it with a mixture of graphite and motor oil.

TRUING A WHEEL

With proper care, avoiding road shocks or running into and over street curbs, the wheel rims seldom require attention. When truing becomes necessary, you had better have a bicycle mechanic do it for you, because it is a job more easily demonstrated

FIG. 120. KNOCKING DOWN THE BIKE FOR SPRING REPAIRS

FIG. 121. REMOVING THE ECCENTRIC CRANK HANGER FOR CLEANING AND GREASING

than described. Watch how he does the work, and it may be that you can get the knack of it so that another time you can tackle it yourself.

NEW RIMS AND SPOKES

When a rim is badly out of line, it requires replacement. Assembling a rim, hub and spokes is a job that few novices can do, and the retail cost of the rim and spokes is little less than the bicycle mechanic will charge, provided that he uses your old hub.

CARE OF TIRES

With proper inflation, by air-gauge and not by guesswork, and with a good measure of luck in avoiding tacks, nails and glass, a pair of tires should last several years. A pressure of 28 pounds is correct for balloon tires and 38 pounds for single tires. A cold patch applied to a puncture according to the repair kit directions may last indefinitely, but it is advisable to have the patch replaced by a vulcanized job.

When the bicycle is not in use for any length of time, support the front wheel so that the weight of the bicycle does not rest on the tires. It is supposed that the rear wheel is provided for by a frame stand.

CARE OF THE FRAME

The baked enamel of a bicycle frame will last a long time without requiring attention, except for

washing. Soften hardened mud with water until it comes off readily. Never scrape it off because you will scratch the enamel in doing so. Remove grease with an automobile cleaner, and with an occasional waxing the finish will remain as new looking as that of a waxed automobile.

RENEWING THE FRAME ENAMEL

Scratches through the enamel may be retouched with a small brush and the same color and shade of enamel, so that they will be hardly noticeable. When the finish has become so damaged that the entire frame must be refinished, sandpaper the old enamel down to the bare metal, or even it off so that it is smooth. Wipe off the sanded surfaces with a rag wet with turpentine, then apply a coat of automobile enamel. Do your enameling in a room free from dust. Flow on the enamel with a 1½-inch brush, brushing it well so that there will be no laps. Two coats will make a first-class job if carefully applied. Rub down the first coat lightly with No. 00 sandpaper.

REFINISHING RIMS

Rims require attention sooner than frames, especially those of natural wood finish. To refinish them, remove the varnish with varnish remover, then if the bare wood is spotty, bleach it with oxalic acid. Smooth with sandpaper. Shellac and then varnish with two coats of spar varnish.

Instead of removing the finish of "natural" wood rims, it is easier to enamel a dark color that will cover stains and scratches.

Rusted and scratched metal rims should be sandpapered, then given two coats of aluminum or enamel paint.

REJUVENATING AN OLD BIKE

Two worthwhile and inexpensive replacements for an aging bike are new pedals or new pedal pads, and new handlebar grips. With the frame reenameled and the rims refinished as suggested above, the handlebars replated, or the plating brightened with metal polish, and the saddle dressed with shoe polish, your overhauled bicycle will have the appearance of a new model.

If you have fallen heir to an old bicycle, that has been parked for a decade or more in an attic, you may be able to rejuvenate it by replacing parts. A new pair of rims to replace twisted rims, and a new set of tires will probably restore it to good running condition.

Chapter VII

A BICYCLE TRUNK AND A TRAILER

A Bicycle Trunk—A Bicycle Trailer—Adapting a Wagon for a Trailer

My other books have shown you how to build a bike garage and bicycle accessories of several kinds. In this chapter I show how to build a bicycle trunk and two forms of trailers.

A BICYCLE TRUNK

A trunk like that in Fig. 122 makes a fellow's bike of greater utility for carrying books to and from school, for packing duffle on bicycle trips, for doing Mother's marketing and for delivering newspapers and circulars.

The trunk rack is easy to make, as you will see by Fig. 123. The top (A) is a board of the dimensions given in Fig. 124. Its front end is bolted to the bicycle frame, and its rear end is supported by struts (B) pivoted to the under side and fastened to the rear axle. Since the struts are pivoted, they can be folded against the board, for compactness, when you remove the rack from the bicycle.

The strut frame is shown in detail in Fig. 125. Get two lengths of flat iron bar of about the dimensions given in Fig. 126, for the struts (B). The bar

iron from an old awning frame will do very nicely. If you cannot pick up an awning frame, buy a strip of flat iron bar at your local hardware store or from

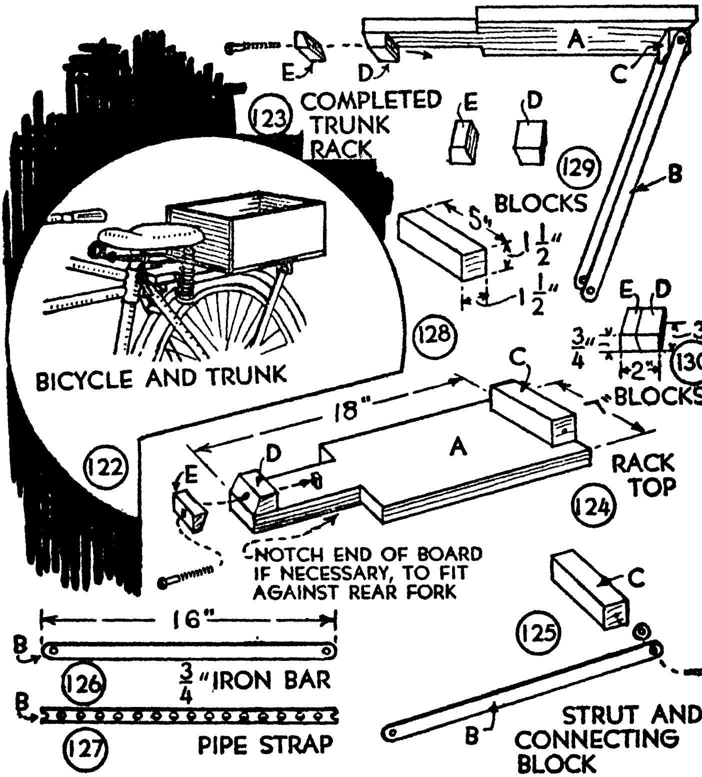


FIG. 122. A BICYCLE TRUNK
FIG. 123. THE TRUNK SUPPORT
FIGS. 124-130. DETAILS OF TRUNK RACK

a blacksmith, or buy a strip of pipe strap from a steam fitter (Fig. 127). An advantage in using the latter is that it has holes punched through it. A hole

is necessary at one end of the strut to fit over the rear wheel axle, and another hole is necessary at the other end through which to screw the strut to the connecting block (C, Fig. 124). Make the lower end hole a trifle larger than the axle. You can enlarge a hole in pipe strap with a rattail file.

Cut the connecting block (C) of the dimensions given in Fig. 128. Screw one of the iron struts to each end, with common screws or lag screws ¼ inch in diameter and 1½ inches long, then screw the rack top to the block.

THE FRONT OF THE RACK requires two connecting blocks (D and E, Fig. 129). These blocks must be beveled to fit against the rear fork of the bicycle frame. Figure 130 shows their dimensions. Cut them in one piece, then rip the piece in half at the angle to give the blocks the required bevel to fit against the frame. Bore a pair of holes through the block, before ripping it, for ¼-inch stove bolts. Get stove bolts 3 inches long with which to bolt the blocks to the frame.

FINISHING THE RACK. When you have assembled the parts and made the adjustments necessary for a well fitted job, sandpaper all surfaces and apply two coats of automobile enamel of as nearly the shade of your bicycle frame as you can get.

THE TRUNK may be a box cut down to a depth of about 4 inches, but a box built up of selected boards will be a neater job. Bolt the trunk to the rack top with stove bolts.

FINISH THE TRUNK with enamel to match the bicycle frame, or use a contrasting color.

A BICYCLE TRAILER

You will find the trailer in the diagram of Fig. 131 a good investment of time and effort, which are practically all that it costs to build. It will make possible jobs of hauling and probably you can negotiate a parcel delivery service that will net you a worth while spare-time income.

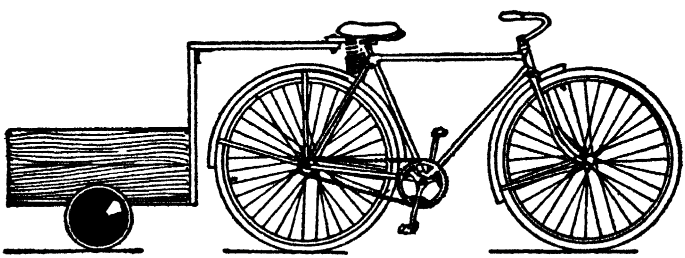


FIG. 131. A TRAILER MAKES POSSIBLE A PARCEL DELIVERY SERVICE AND JOBS OF HAULING

THE TRAILER BOX may be a large packing box. Maybe you will find one, maybe not. With the increased use of cardboard cartons for shipping purposes there has resulted a scarcity of packing boxes, much to the misfortune of boys, since boxes have always been boys' best source of building material. If you do not find a box about 12 inches deep, 24 inches wide and 30 inches long, or a larger box that you can cut down, build one out of scrap lumber. Crating material will do, and this is usually easy to get at the season of the year when the demand for kindling has dropped off. I am not going to tell you how to build the box, because there is nothing to it that you

cannot discover by examining a box. Be sure to do a good job of nailing.

THE WHEELS may be rubber-tired velocipede wheels or baby buggy wheels. Of course, you must get the axle, nuts and washers, and you must have staples, pipe straps, bolts or nails with which to attach the axle to the box.

Cut a 2-by-4 bolster and fasten it across the center of the box bottom (Fig. 133). Then fasten the axle along the bolster. If the axle is drilled, or if you can drill holes through it, the best way to attach it is

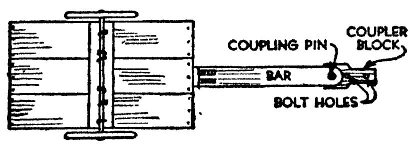
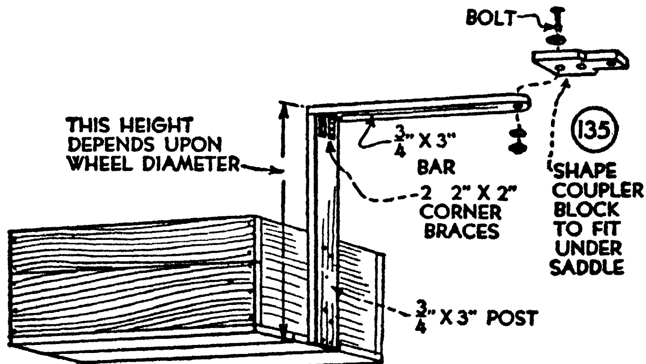


FIG. 132. PLAN OF TRAILER CHASSIS AND COUPLER

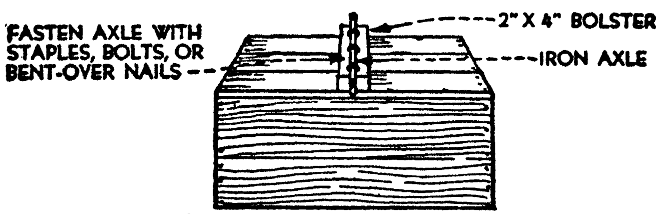
with bolts or lag screws. Lag screws have square heads that you turn with a wrench. Otherwise, use staples or bent-over nails.

THE COUPLER. Figure 132 is a plan of the trailer and its coupler. Figure 134 is a detail of the trailer box and coupler post and bar, and Fig. 135 is a detail of the coupler block. Cut the post and bar from a board ¾ inch thick and 3 inches wide. Their lengths are not given because these will depend upon the height of the trailer wheels and your bicycle. You can determine what the measurements should be. Nail the bar to the post top, and screw a pair of 2-by-2 corner braces to the bar and post, as shown in Fig. 134. Nail or screw the coupler post to the front of the trailer box.

Cut the coupler block (Fig. 135) to fit under your bicycle saddle. The type of saddle will determine the size and shape of the block. Drill holes through the block for bolts or for wire, for fastening



134 DETAIL OF TRAILER BOX AND COUPLER



133 BOLSTER AND AXLE

Fig. 133. detail of trailer bolster and axle
Fig. 134. detail of trailer box and coupler
Fig. 135. coupler block

to the saddle frame, and bore a ⅝-inch hole through the block, and another through the coupler bar, for a carriage-bolt coupling pin (Fig. 132).

FINISH THE TRAILER with two coats of paint. You can match the color of the frame of your bicycle, or use a contrasting color.

ADAPTING A WAGON FOR A TRAILER

If you have ever towed a wagon behind your bicycle, you have discovered that every time you slowed down the wagon bumped into you. Figure

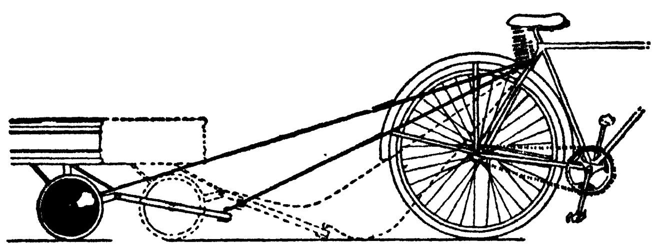


FIG. 136. THE SIMPLEST BICYCLE TRAILER IS A WAGON WITH A HITCH LIKE THIS

136 shows how to remedy this by making the wagon tongue serve as a brake. Cut the tongue short, as shown, then attach two ropes, one to the end of the tongue, the other to a point just back of where the tongue joins the axle. Tie the free end of each rope to the bicycle frame, as shown.

Now, when you ride, the ropes will pull taut and the tongue will be lifted free of the pavement. But when you slow down, the tongue will drop to the pavement, as indicated, and will act as a brake.

A block of wood with a piece of tire rubber tacked to it, attached to the end of the wagon tongue, will improve the braking efficiency.

Chapter VIII

FOR YOUR OUTDOOR GYMNASIUM

A Trapeze—A Swing—Flying Rings—A Horizontal Bar—A Striking Bag Canopy—Jump Standards—A High-Low Hurdle

GET the fellows to coöperate with you in organizing an outdoor gymnasium. They will use it quite as much as you and should require little persuasion. Building apparatus will be fun for all and you can knock it together quickly. Several pieces of home-made equipment are described in this chapter and there should be other ideas among you.

A TRAPEZE

First of all, erect a trapeze because that will probably be the most popular apparatus.

THE SUPPORT. If there are two trees not more than 10 feet apart, the best support will be a framework spiked across the trunks as shown in photograph Fig. 137 and detail Fig. 139. If no suitable trees are available, support one end of the hanger beam upon a wall of your house or garage, the other end upon a post built up of two or three 2-by-6s embedded in concrete and braced for rigidity.

THE HANGER BEAMS of the tree support will vary in size, depending upon the span. A pair of 2-by-6s or 2-by-8s will do for a span of 10 feet. Figure 139

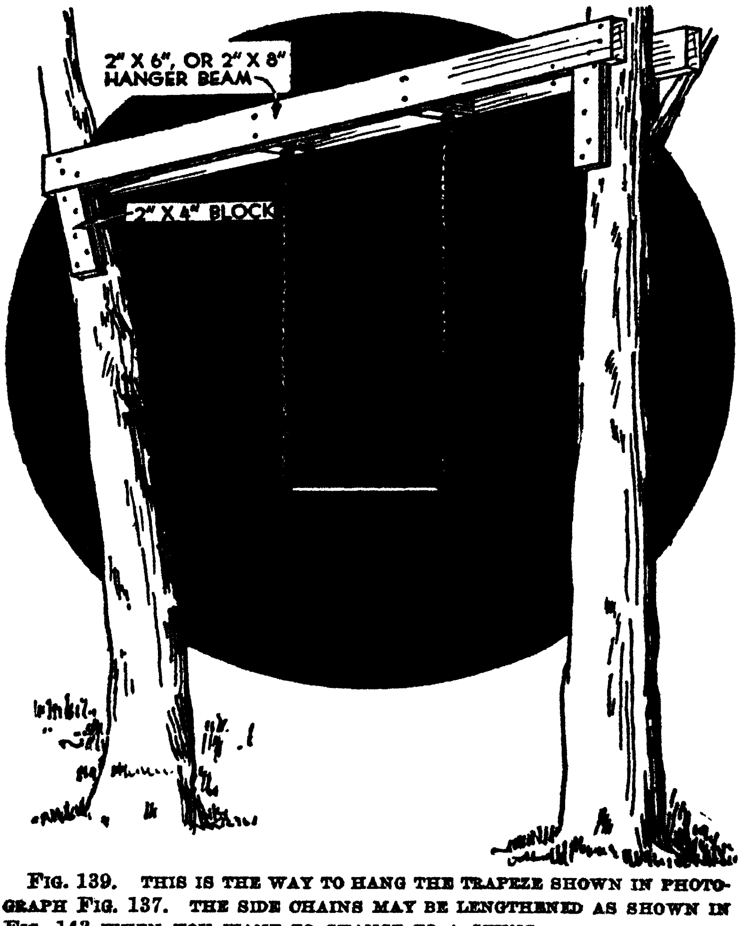


FIG. 139. THIS IS THE WAY TO HANG THE TRAPEZE SHOWN IN PHOTOGRAPH FIG. 137. THE SIDE CHAINS MAY BE LENGTHENED AS SHOWN IN FIG. 143 WHEN YOU WANT TO CHANGE TO A SWING

FIG. 137. A TRAPEZE AND FLYING RINGS WILL PROBABLY BE THE MOST POPULAR APPARATUS

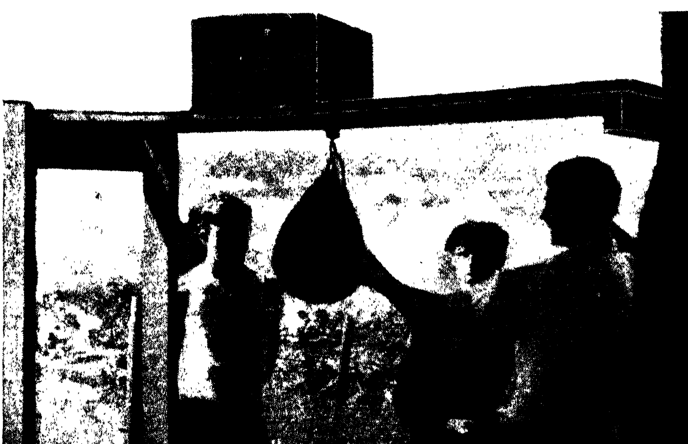


FIG. 138. BUT THE STRIKING BAG WILL RANK A CLOSE SECOND

shows how to spike the beams to opposite sides of the tree trunks, with 2-by-4 blocks spiked below their ends for reinforcement.

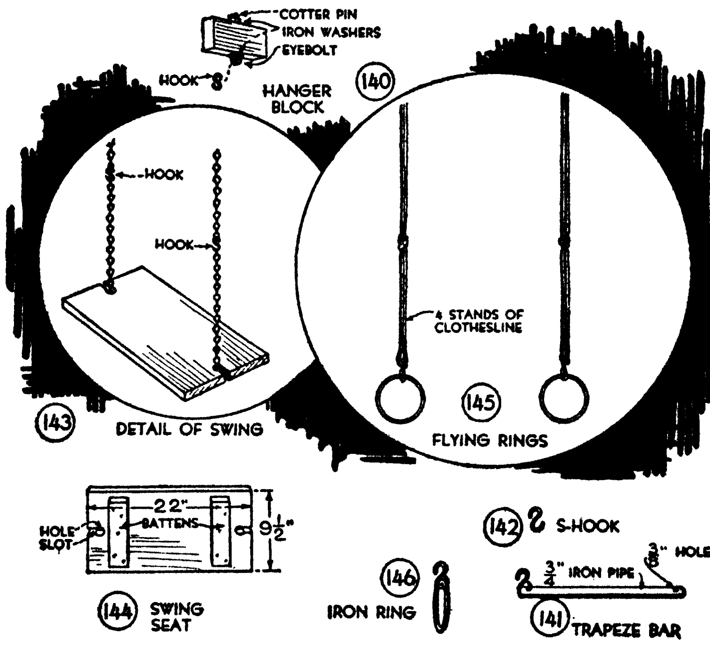


FIG. 140. OVERHEAD HANGER BLOCK FOR TREE TRAPEZE
FIGS. 141-142. DETAILS OF TRAPEZE BAR
FIG. 143. DETAIL OF SWING
FIG. 144. PATTERN FOR SWING SEAT
FIG. 145. FLYING RINGS
FIG. 146. DETAIL OF RING

CUT A PAIR OF HANGER BLOCKS to fit between the beams (Fig. 140). Bore a ½-inch hole through the center of each block for ½-inch eyebolt hangers. Set in the eyebolts as shown in Fig. 140, with large wash-

ers between the blocks, bolt eyes and nuts. Also, drill holes through the bolts above the nuts, for cotter pins, to prevent the nuts from working off. Spike the hanger blocks 20 inches apart (Fig. 139).

MAKE THE TRAPEZE BAR of a piece of ¾-inch galvanized pipe 20 inches long (Fig. 141) and two hammock S-hooks (Fig. 142). Drill holes at the pipe ends of the right size for the S-hooks to slip through. Hammer over the hook ends to make them hold fast in the pipe holes.

USE HAMMOCK CHAIN for hanging the trapeze, and hammock S-hooks for connectors. The length of the trapeze chains should be such that the bar will hang about 48 inches above the ground. The bar can be set higher by engaging the bar hooks in higher links of the chain, and it can be set lower by adding lengths of chain.

A SWING

Figure 143 shows how to extend the trapeze chains for a swing. Make the seat of a 10-inch board cleated upon the under side like that in Fig. 144. Cut end slots as shown for the chain to slip through. Attach the extension chain with S-hooks, as shown in Fig. 143, and let the loop pass through the slots and under the seat.

FLYING RINGS

To convert the trapeze apparatus into flying rings (Fig. 145), replace the bar with rings. Have a

blacksmith weld a pair of 5 or 6-inch rings out of ½-inch iron rod (Fig. 146). Slip a hammock hook over each ring, and hammer the engaged end of the hook to form an eye that will hold fast to the ring.

CLOTHESLINE HANGERS may be substituted for chain, as shown in Fig. 145. Use four strands and knot them a foot or so above the rings.

A HORIZONTAL BAR

If you want a horizontal bar in addition to the trapeze, set it up as shown in Fig. 147.

THE SUPPORTS. You can support one end upon a tree trunk and the other end upon a 2-by-6 or heavier upright. Brace the upright with 2-by-4 diagonals. Saw off the upper ends of the diagonals to fit the sides of the upright and bolt them to the upright. Bolt the lower ends to stakes driven into the ground.

MAKE THE BAR of a piece of 1-inch pipe, which measures 1¼ inches outside. Have the ends threaded to fit *floor flanges* (Fig. 148). Screw the flanges onto the pipe and then screw them to the bar supports with lag screws.

Sandpaper the pipe bar, then apply a coat of flat paint, and when this has dried, apply a coat of automobile enamel, or apply several coats of lacquer.

A STRIKING BAG CANOPY

The striking bag will probably vie with all other apparatus for first place in popularity. Photograph

Fig. 138 shows an easily erected canopy from which to swing a bag.

BUILD THE CANOPY between two trees about 6 feet apart, or, if two such trees are not at hand, support

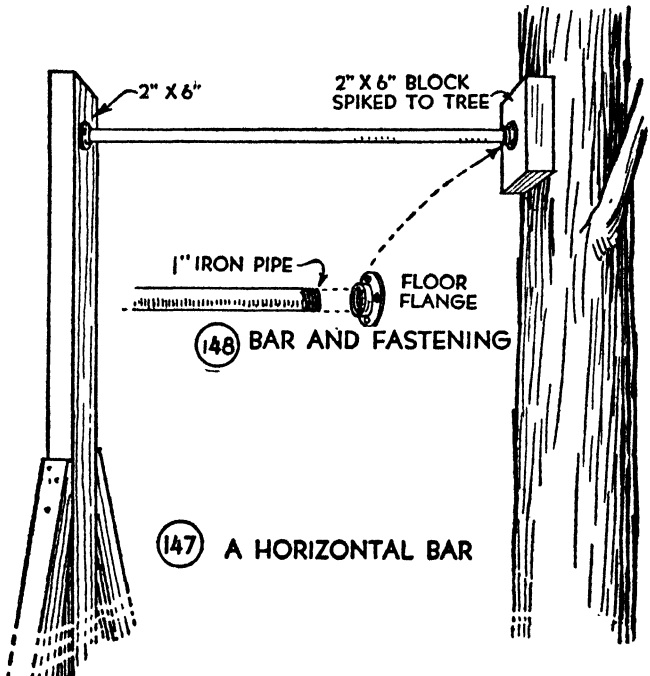


FIG. 147. IF YOU WANT A HORIZONTAL BAR IN ADDITION TO THE TRAPEZE, ERECT IT THIS WAY
FIG. 148. DETAIL OF BAR AND FASTENING

one end on a tree, the other end upon 2-by-4s, as shown in Fig. 149.

Use matched boards for the canopy (Fig. 150) if you can get them. Make end battens of 2-by-4s.

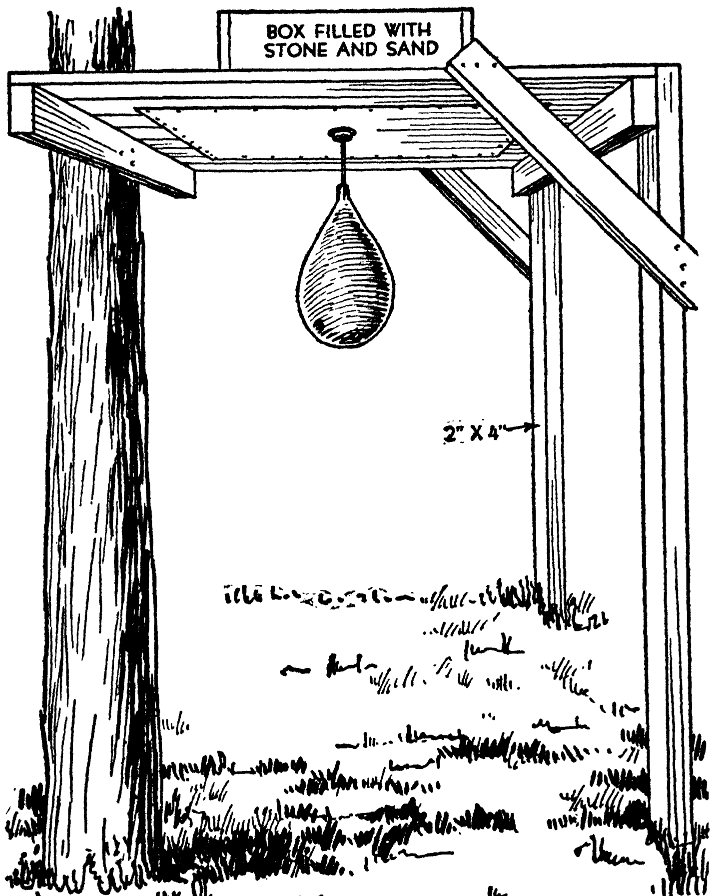


FIG. 149. THIS IS THE WAY TO SUPPORT THE STRIKING BAG CANOPY SHOWN IN PHOTOGRAPH FIG. 138

Drive the boards close together and nail them to the battens with 6-penny nails. If the boards are smooth, finish the under side, or striking surface, with shellac, rub lightly with sandpaper and add a coat of spar varnish. Or cover the surface with a piece of table oilcloth, as indicated in Fig. 150. Paint the top of the canopy with two coats of paint.

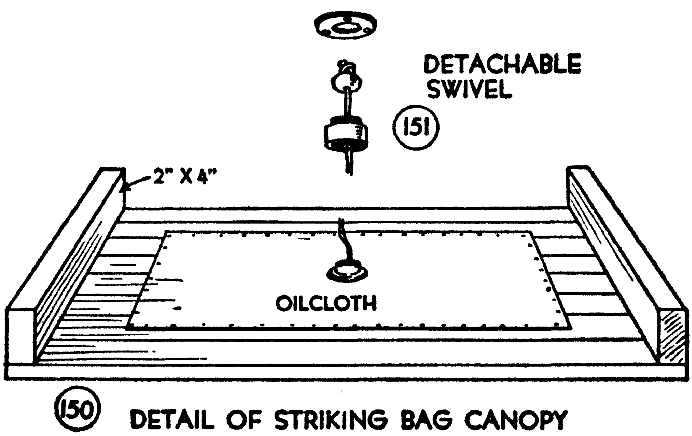


FIG. 150. DETAIL OF STRIKING BAG CANOPY
FIG. 151. DETACHABLE SWIVEL FOR STRIKING BAG HANGER

THE STRIKING-BAG SWIVEL should be screwed to the center of the striking surface. A detachable swivel of the type shown in Fig. 151 is handy, because its lower portion can be unscrewed with a few turns and removed with the bag.

BRACING. When you have erected the supports and mounted the canopy, fasten 1-by-4 diagonals from the canopy to the corner posts to make greater rigidity.

BALLAST is necessary to effect a solid striking surface. To provide for this, place a box on top of the canopy and fill it with sand or stone, as shown in Fig. 149.

JUMP STANDARDS

You will need a pair of standards like those in Fig. 152 for the high jump and pole vault. The uprights may be set in the ground, but bases are preferable.

THE UPRIGHTS are 1-by-2 strips 7 feet long. Mark off one edge into "inches," beginning 24 inches from the bottom, and scribe the "foot" and "half-foot" marks across the faces. Go over the markings with black paint to make them permanent.

THE BASES shown in plan in Fig. 153 are made by nailing 1-by-3 strips to the sides of the uprights in the order indicated.

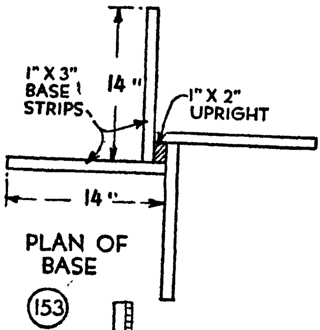
THE BAR SUPPORTS, or rope supports, are a pair of C-clamps (Fig. 154). Buy a pair at the dime store if you do not find some at home.

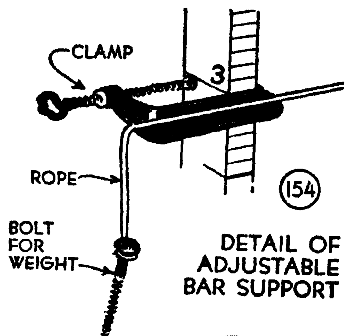
THE BAR may be a pole selected from the pile of rippings at a mill, but since bars are easily broken you may prefer

A ROPE SUBSTITUTE (Fig. 152) with a bolt or other piece of hardware attached to each end, as shown in Fig. 154.

A HIGH-LOW HURDLE

An adjustable hurdle is a simple apparatus to build. Figure 155 shows the high hurdle adjustment





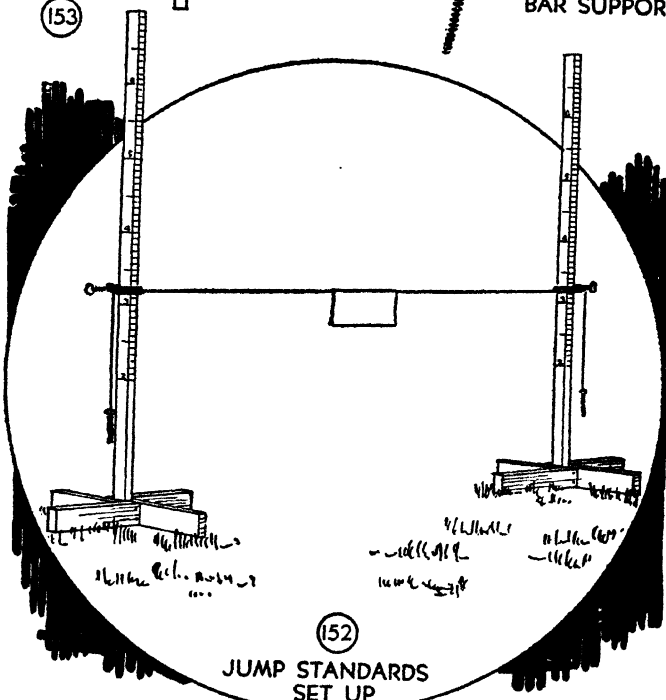


FIG. 152. YOU WILL NEED THESE STANDARDS FOR THE HIGH JUMP AND POLE VAULT

FIG. 153. PLAN OF BASE

FIG. 154. DETAIL OF ADJUSTABLE BAR SUPPORT

with a clearance of 42 inches and Fig. 156 shows the low hurdle adjustment with a clearance of 30 inches. Dimensions of parts and assembly details are given in Figs. 157 to 159.

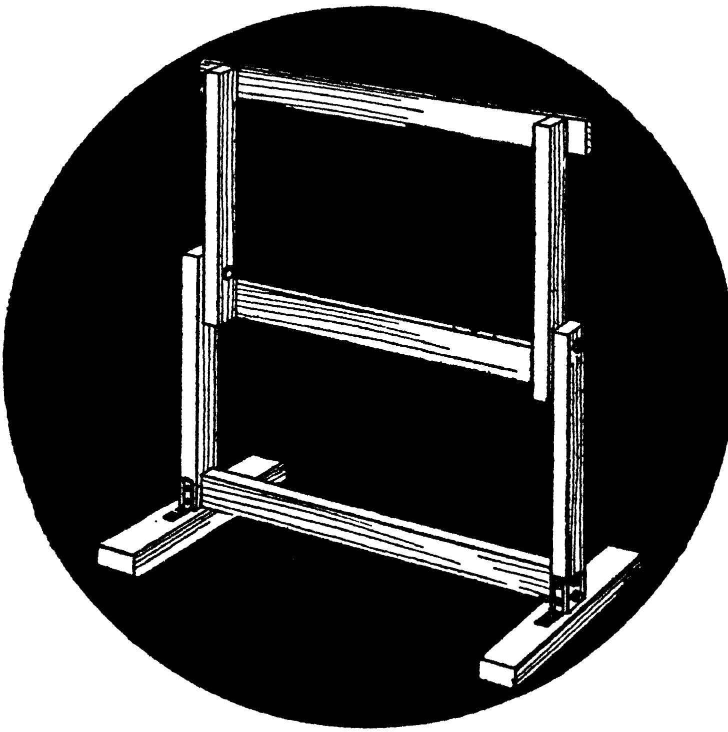


FIG. 155. THIS HIGH-LOW HURDLE IS EASY TO BUILD

THE MATERIAL required is two pieces of 2-by-4 8 feet long, one piece of 1-by-4 6 feet long, two ½-inch carriage bolts 4½ inches long and eight iron washers, four ⅜-inch lag screws 4 inches long and four iron washers, one dozen ³⁄₁₆-inch screws 1¼ inches

long and four 3-inch corner braces with screws to fit them.

THE FRAME SUPPORT is detailed in Figs. 158 and 159. Cut the pair of base blocks 22 inches long and the pair of uprights 24 inches long. Stand the up-

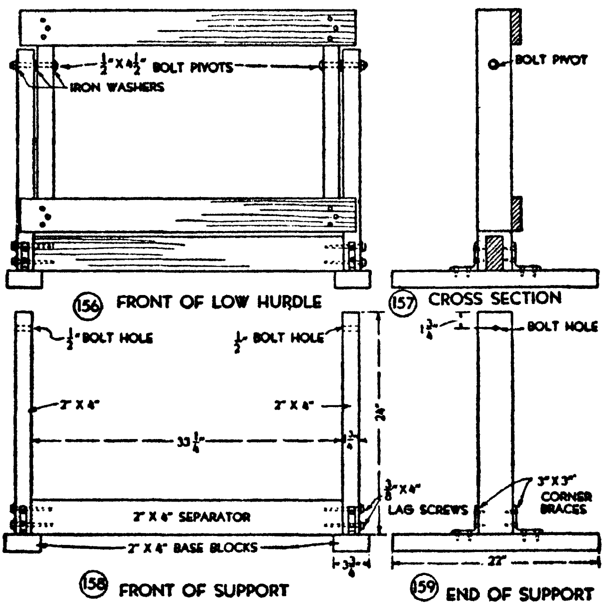


FIG. 156-157. FRONT AND CROSS SECTION OF LOW HURDLE
FIGS. 158-159. DETAILS OF HURDLE SUPPORT

rights upon the center of the base blocks and fasten each with a pair of iron corner braces screwed to their opposite edges and to the base blocks. With the uprights mounted, cut the 2-by-4 separator 33¼ inches long and fasten it between the uprights with the lag screws specified, using two for each end. Drill ⅜-inch holes through the uprights for the lag

screws. Place an iron washer under the head of each screw. Turn the screws with a wrench.

THE TILTING FRAME is detailed in Fig. 160. Cut two 2-by-4 uprights 24 inches long and two 1-by-4 bars 36 inches long. Place the bars across the edges of the uprights with their ends projecting 1¾ inches, and fasten them with three ⅝6-inch screws in each

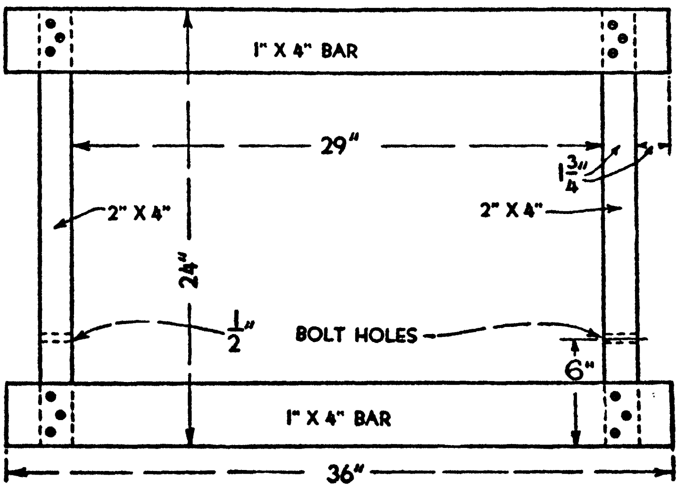


FIG. 160. DETAIL OF HURDLE FRAME

end. It is important to place the bars at right angles to the uprights so that the frame will swing with equal clearance at both ends. Test the corners with a square before you screw the bars in place.

Bore a ½-inch hole through each frame upright 6 inches from one end, as indicated in Fig. 160, for pivot holes. It is important to get them exactly opposite and to bore them straight.

TO MOUNT THE FRAME slip the bolts through the

holes in the uprights, placing an iron washer next to each bolt head, two washers between the frame and support upright and a fourth washer under the nut.

FINISHING. With the hurdle completed, knock it down, round off all edges with sandpaper or a plane and give the surfaces two coats of white paint.

Chapter IX

IT'S BIRD HOUSE SEASON

A Thatched Wren Hut—A Rustic Robin Shelter—A Nesting Material Depot

THE best time to build bird houses is in late Winter or very early Spring, so that you may put them up before the birds return. This gives the weather a chance to get in some seasoning, the paint time to lose its odor, and there is more likelihood of tenants. But if you are late with your home offerings, the houses will at least add interest to the lawn and garden and there is the possibility of course, that some of them may be occupied later for mid-season broods.

A THATCHED WREN HUT

I am sure that you will like the wren hut shown in photograph Fig. 161, a model selected from many on my studio grounds. I built it of grocery-box boards and added an old broom to its roof for thatching. A detail is shown in Fig. 164, and the assembly is indicated in Fig. 165.

THE WALLS are easy to cut. A pattern for the *front* and *rear* walls is given in Fig. 166, a pattern for the *sides* is given in Fig. 167 and a pattern for the *roof boards* is given in Fig. 168. One roof board

must be narrower than the other, to allow for overlapping. The boards used for this house measured ⅜ inch thick, so one roof board is that much narrower than the other. The roof boards do not pro-

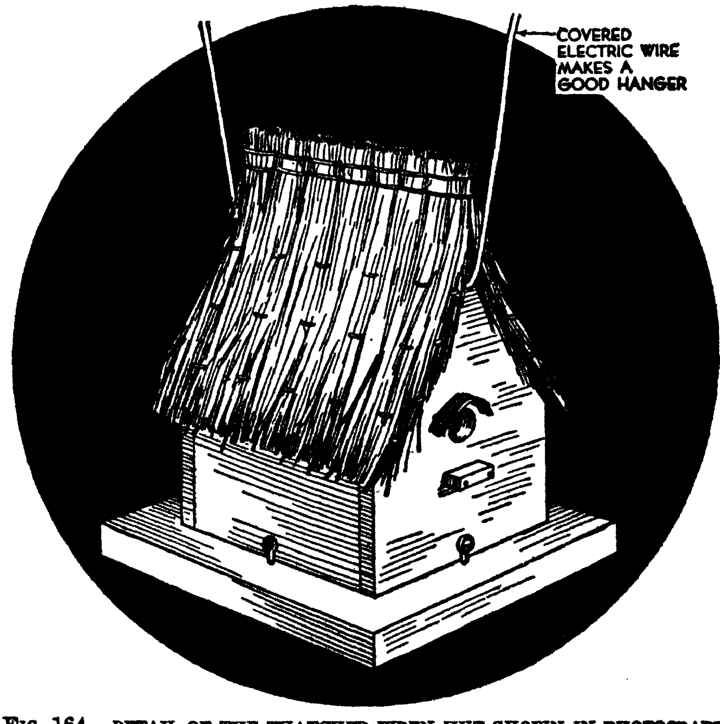


FIG. 164. DETAIL OF THE THATCHED WREN HUT SHOWN IN PHOTOGRAPH FIG. 161

ject over the front and rear walls, but are flush with them. To prepare the pattern for the front and rear walls (Fig. 166), draw the center line, which extends through the roof peak, then lay off the measurements each side of it and draw the outline. Bore a

FIG. 162 FIG. 163

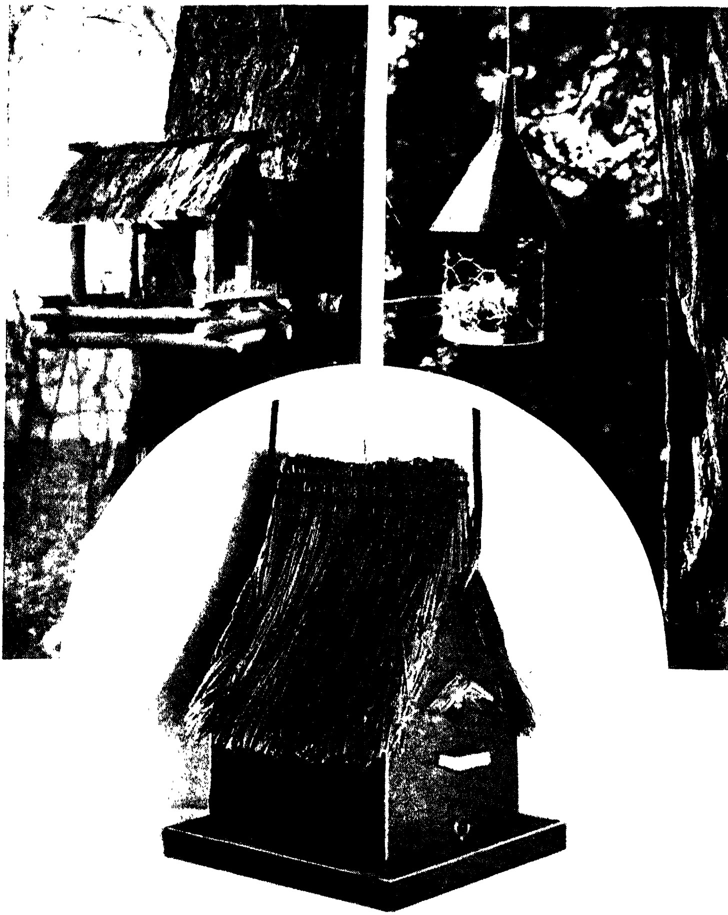


FIG. 161

FIG. 161. A THATCHED WREN HUT
FIG. 162. A RUSTIC ROBIN SHELTER
FIG. 163. A NESTING MATERIAL DEPOT

¼-inch hole through the front and back near the peak for a hanger wire.

THE DOORWAY for a wren house should be ⅞ inch in diameter. If you haven't a large enough bit, bore a smaller hole and enlarge it with your coping saw or with a rattail file. Mark out the opening by drawing around the rim of a silver quarter if you haven't a pencil compass.

THE FLOOR is shown in Figs. 165 and 170. It is 2 inches wider and longer than the house. Locate the position for the house by drawing a line 1 inch inside of the edges, as shown in Fig. 170.

PROVISION FOR REMOVING OLD NESTS. When you have cut the floor board, drive four 1-inch screw eyes into the upper face, just outside of the wall lines and centering on the lines, as shown in Fig. 170. These screw eyes are to provide a means of fastening the floor to the house so that it can be removed easily to clean out old nests. Screws are to be driven through the eyes into the walls of the house, as shown in Fig. 164.

ASSEMBLE THE HUT as indicated in Fig. 165. Use 2-penny finishing nails for nailing. Fasten a block of the size shown in Fig. 169 1 inch below the doorway, for a perch.

PAINT THE HUT with two coats of paint before you thatch the roof. After the first coat has dried, putty the nail holes. Light green walls and a darker green floor make a pleasing contrast to the straw roof.

THATCHING THE ROOF is easy. It does not matter how worn the broom is that you use, provided that

the shortest straws are long enough to extend a trifle below the ends of the roof boards. By ripping out

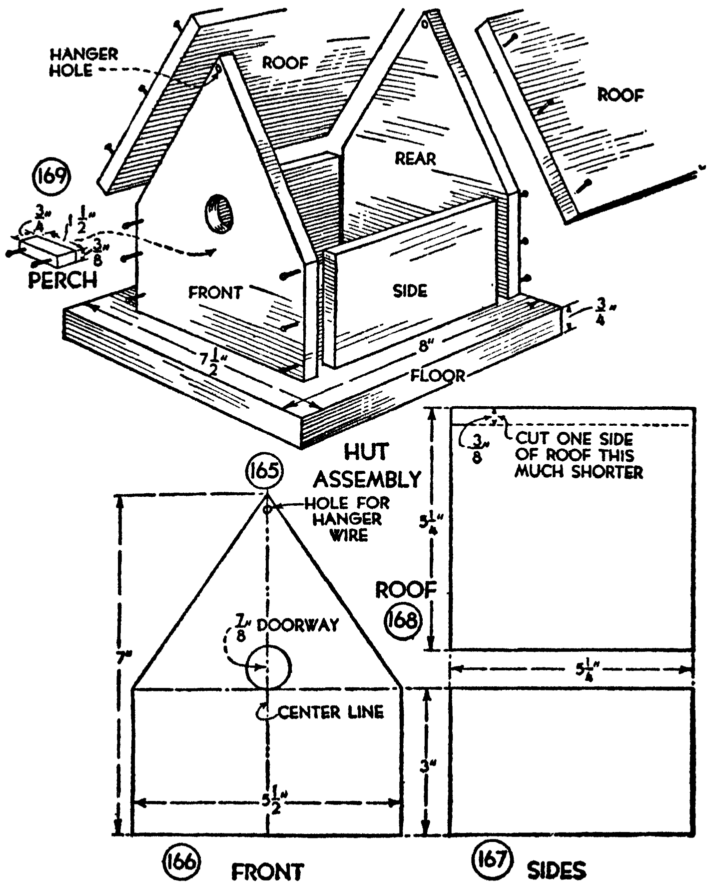


Fig. 165. HUT ASSEMBLY
Figs. 166-169. PATTERNS FOR WALLS, ROOF, AND PERCH STICK

one or two of the cord stitchings, as indicated in Fig. 171, a greater length of straw is available.

Set the broom down over the roof so that the straws will be parted at the middle, as shown, and staple the straws to the roof boards with staples ¾ inch long. Press the straws together at the roof ends to form projections of equal thickness and fasten them with staples. Saw off the broom just above the top stitching. Trim off the lower worn edges of the straw with scissors.

Make a doorway canopy of a small bunch of straws bent as shown in Fig. 172. Fasten it over the doorway with a pair of staples.

Paint the straw roof to protect the straw from the weather and to discourage birds from taking it for nesting material. Use chrome yellow, and apply two or three coats so that the paint will bind the straws together. Also paint the straw canopy.

Hang the wren hut at a height of from 6 to 10 feet. A good *hanger* will be found in a piece of covered electric wire. Run the wire through the holes in the peak of the front and rear walls, as shown in Fig. 164, and leave the ends long enough to loop over a tree branch or other support.

A RUSTIC ROBIN SHELTER

Since rustic houses have a natural weathered finish, there is not the chance of delayed occupancy that is often the lot of painted shelters. Building rustic houses is well adapted to one's vacation period if that be spent in the woods.

Three Sides Must Be Open. That is the most important specification for a robin shelter. I modified

it, in the shelter in photograph Fig. 162, providing a ledge around the floor to hold nesting material.

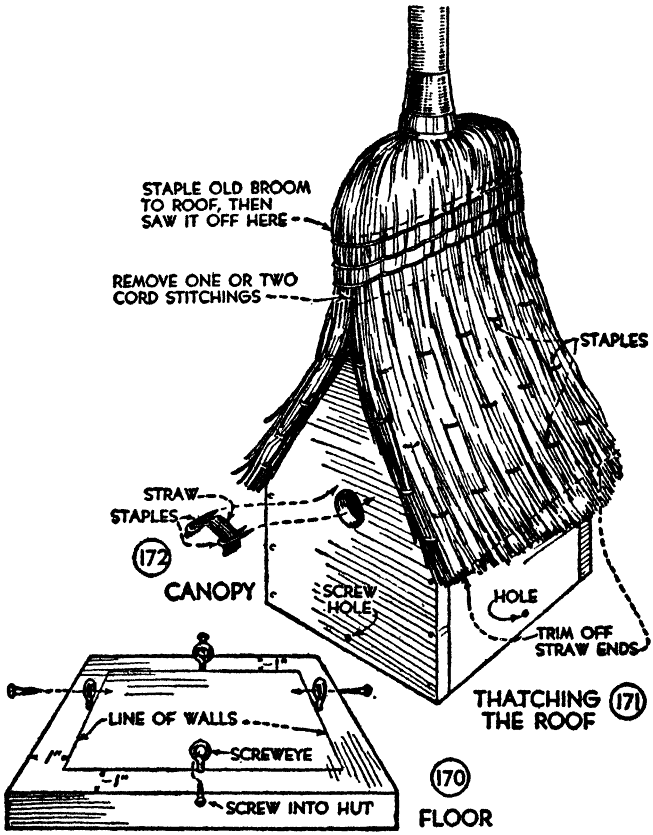
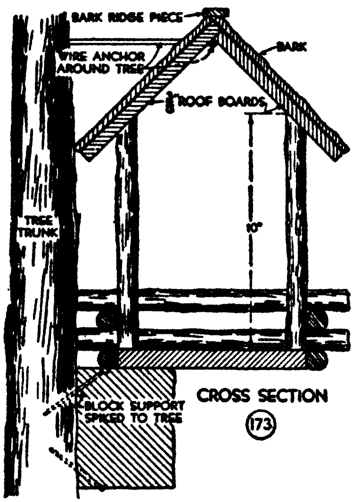


FIG. 170. DETAIL OF FLOOR
FIG. 171. ATTACHING BROOM TO ROOF FOR THATCHING
FIG. 172. THATCHED CANOPY FOR DOORWAY

Figure 173 shows a cross section of the shelter, and Fig. 174 a detail of the floor and corner posts.

Cut the floor board of the size shown in Fig. 174.

The corner posts are straight pieces of branches ¾ inch in diameter and 10 inches long, with the bottom square and the top cut at an angle of 45 degrees, which is the pitch of the roof.



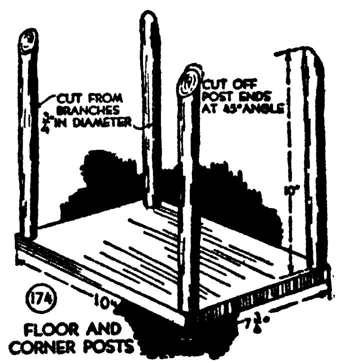


Fig. 173. Cross section of rustic robin shelter shown in photograph Fig. 162

Fig. 174. Detail of floor and corner posts

Two tiers of logs brace the posts. Cut straight branches ½ inch in diameter, and of the right lengths to project 2 inches beyond the corners. Nail the logs to the edges of the floor, and to the posts, placing them as shown in Figs. 162 and 173.

The roof is made of boards ⅜ inch thick and of the right width and length to project 1 inch over the corner posts. Nail them to the post ends. Then cover with pieces of bark and add a bark ridge piece.

Hang the robin shelter upon a tree trunk, as shown in Fig. 173. Spike a block to the tree to support the bottom, and run a wire through the shelter below the roof peak, then around the tree, to anchor the top.

A NESTING MATERIAL DEPOT

A self-help supply depot like that in photograph Fig. 163, stocked with bits of string and thread, wisps of dried grass and hair is a little luxury that may increase nesting activities in and around your garden. Hang it from a tree branch in view of your window, and you will be rewarded by the sight of dozens of birds flying to it, then away, with nesting material.

The depot is easy to make, you will note from detail diagrams Figs. 175 to 180.

The roof is a 6-inch tin funnel (Fig. 176).

A center post ¾ inch square and 11½ inches long, with the top whittled round and tapered to fit the spout of the funnel (Fig. 177) is driven into the funnel and held with a brad driven through the spout. A screw eye in the top provides for the attachment of a wire hanger.

The bottom is a tin can cover 4 inches in diameter (Fig. 178). A screw through its center fastens it to the center pole.

The cage enclosure is made of a scrap of poultry netting 6 by 15 inches in size. Buy a foot of the narrowest netting carried at the hardware store. Form a cylinder of the right diameter to fit inside the can

cover bottom (Fig. 179). Bring the cut ends of the piece of netting together (Fig. 180) and twist them around each other.

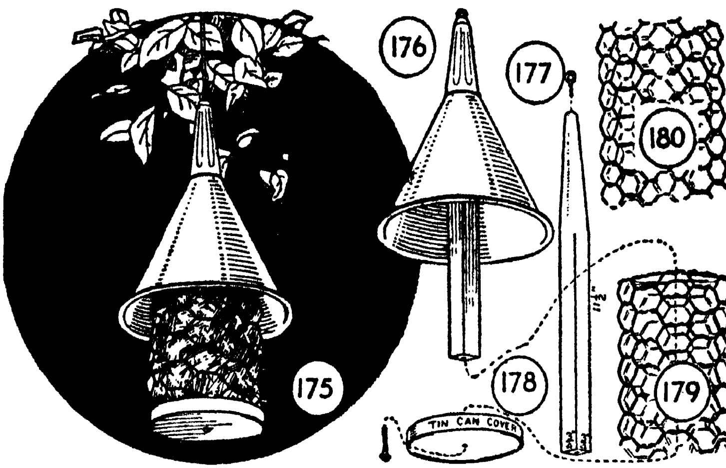


FIG. 175. DETAIL OF NESTING MATERIAL. DEPOT SHOWN IN PHOTOGRAPH FIG. 163
FIG. 176. TIN FUNNEL ROOF
FIG. 177. CENTER POLE
FIG. 178. CAN COVER BOTTOM
FIGS. 179-180. DETAILS OF POULTRY NETTING CYLINDER

THE ASSEMBLY of the parts of the depot is clearly indicated in details Figs. 176 to 179.

PAINT THE DEPOT to prevent its rusting. You can make it all white, or white with a green roof.

Chapter X

BIRD POOLS AND BATHS

A Shallow Pool in a Rockery—A Tub Pool in a Rockery—A Small Concrete Pool—A Garbage-Can Cover Bird Bath—A Boiler Cover Bird Bath

IF YOU have built and put up some bird houses and shelters this Spring, you may reasonably expect birds to accept your home grounds as familiar territory. But, in addition to shelters, you would do well to build a bird pool or two and a bird bath, plant berry bearing shrubs* and serve notice upon cats and other bird enemies that they are unwelcome. Do this and results will more than repay you for your efforts.

A SHALLOW POOL IN A ROCKERY

If Mother has a rock garden, or is planning to build one, it will be just the place for a bird pool like that shown in Fig. 181.

A WASH BOILER COVER (Fig. 182) is to be used for this pool and since covers always outlast the boilers you should have no difficulty in finding one. A cover is especially good for a bird pool because it is shallow, about ¾ inch deep at the rim, sloping down to

*** Write to United States Department of Agriculture, Washington, D. C., for Bulletin 506, "Food for Well Known Birds."**

about 1½ inches deep at the center. Timid birds that might fear to venture into deeper water will bathe in it. True, the shallow pool requires frequent refilling, but that insures fresh water and discourages the breeding of mosquitoes.

TO PREVENT RUSTING. If the cover is of tinned sheet iron, it must be painted to prevent rusting, be-

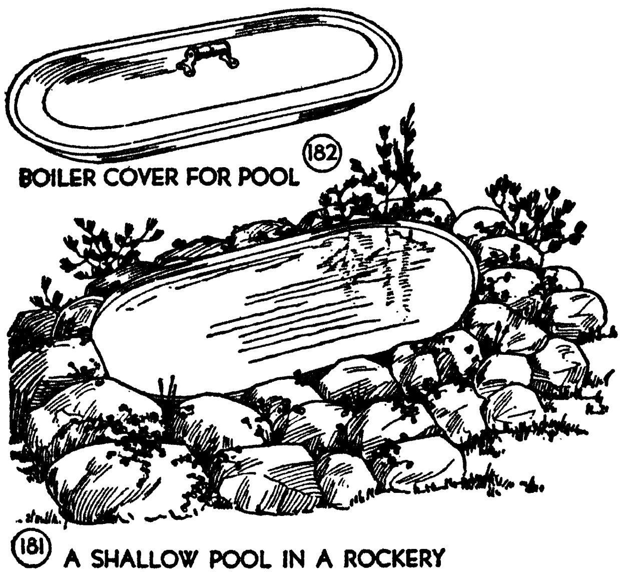


FIG. 181. A SHALLOW POOL IN A ROCKERY
FIG. 182. WASH-BOILER COVER FOR POOL

cause the tinning will soon wear off. The best protection will be a coat of red lead followed by two coats of a good grade of outdoor paint, preferably white, gray or pale blue.

SUPPORT THE COVER IN A ROCKERY and conceal its edges with earth and stones. If you haven't the op-

portunity now to gather field stones from the countryside, embed the cover in a bank of earth and plant a wild garden, leaving the rockery for a later development. But broken flagstones and pieces of concrete from broken walls and street pavements serve the purpose very well, and possibly you may find a few to place on the mound. Field stones, broken

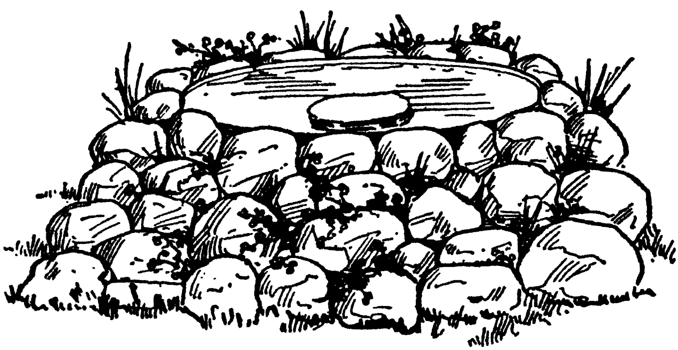


FIG. 183. A WASH TUB POOL IN A ROCKERY

flagstones and concrete must be placed with spaces between them and these spaces filled with earth in which to set rock garden plants. You will find lists of plants recommended for rock gardens in seed catalogues and friends may have slips to offer you.

A TUB POOL IN A ROCKERY

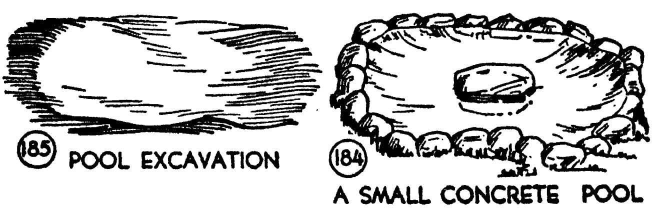
The tub bird pool in Fig. 183 has sufficient depth for water plants and gold fish.

A GALVANIZED IRON TUB is best. It will be too deep when filled for birds to bathe in, so pile flat stones in the center to make a shallow bathing area.

A SMALL CONCRETE POOL

A small pool like that in Fig. 184 is easy to cast.

THE MATERIAL. Three pails of cement mortar will be enough. Prepare this in the proportions of 1 part cement to 3 parts sand, with enough water to make a jelly-like mixture. Buy the cement and sand from a mason or at a material yard. In addition you must have crushed stone or cinders to spread over



FIGS. 184-185. A SMALL CONCRETE POOL

the bottom of the pool, and a piece of heavy poultry netting or wire fencing for reënforcement.

Excavate a hole of the desired shape for the pool, but 4 or 5 inches larger all around than the finished size and 3 inches deeper (Fig. 185). Wet the surface of the excavation with a hose, spread stones or cinders over it and tamp them down to make a firm foundation.

PLACE THE WIRE REËNFORCING next, carrying it over the outside edges of the excavation.

SPREAD THE CEMENT MORTAR over the wire to a depth of about 2 inches and smooth it with a garden trowel or piece of board.

MAKE A RIM OF STONES as shown in Fig. 184. Place

these before the cement has set and fill the spaces between and behind the stones with cement. Place one or more flat stones in the center of the pool.

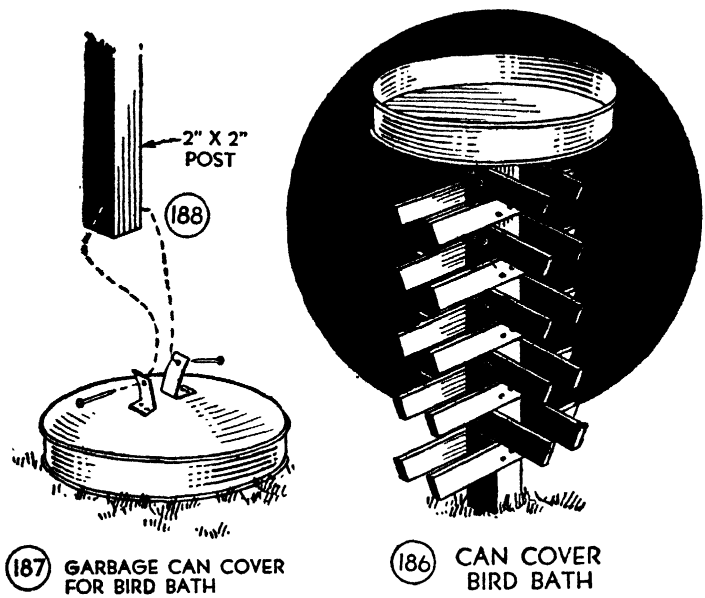


FIG. 186. A GARBAGE-CAN COVER BIRD BATH
FIGS. 187-188. DETAILS OF CAN COVER AND POST SUPPORT

A GARBAGE-CAN COVER BIRD BATH

The bird bath in Fig. 186 is made of a garbage-can cover. Because the cover usually outlasts the can it is easy to find one.

Cut the cover handle in half with a hack saw or tinsnips (Fig. 187), bend up the ears thus formed and nail or screw them to a piece of 2-by-2 or 2-by-4 about 48 inches long (Fig. 188).

Build a trellis like that shown in Fig. 186, with pieces of lath or lattice strip cut 12 inches long with ends slanted as shown. Center the strips upon the sides of the post and nail them in place. Set at least 12 inches of the lower end of the post into the ground for anchorage.

Paint the bath and pedestal with two coats of paint.

A BOILER COVER BIRD BATH

The pedestal bird bath in Fig. 189 has a wash-boiler cover to hold water.

The pedestal is built up of four 1-by-2 uprights and forty-two lattice-strip crosspieces (Fig. 190). Cut the uprights about 30 inches long and the cross-pieces 8 inches long. Cut one crosspiece and use it as a marker for the other pieces.

To assemble the pedestal, place two of the uprights upon a flat working surface so that the distance from outside to outside measures 5 inches. Nail eleven crosspieces to them using finishing nails 1¼ inches long. Nail the first crosspiece to the uprights even with the tops. Place a second crosspiece next to it for a spacer, but do not nail it. Then place a third strip close to the spacer and nail it, then a fourth strip next to the third, for a spacer, and so on until the bottom of the uprights has been reached. The ends of the crosspieces must project equally. Mark the correct projection upon a small block and use this as a guide.

Make a duplicate frame, then connect the two frames with the crosspieces. Figure 190 shows half of the crosspieces nailed on each side. This is not as

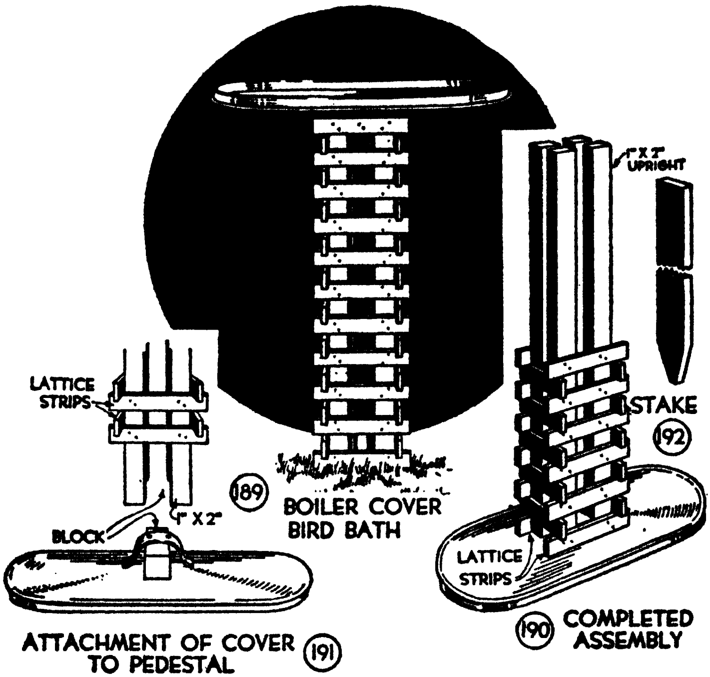


Fig. 189. a wash-boiler cover bird bath
Fig. 190. completed assembly
Fig. 191. attachment of cover to pedestal
Fig. 192. stake for anchoring pedestal

easy a way to assemble the pedestal as the way explained above. The illustration has been drawn this way to make the construction clear.

To mount the boiler cover on the pedestal, drive a block of wood 5 inches long under the cover handle,

as shown in Fig. 191, and nail the handle to the block. Then place the cover on top of the pedestal, with the handle block slipped between the uprights and fasten with nails driven through the top cross-pieces into the block ends.

PAINTING may be simplified by finishing the parts before assembling them, or, at least, applying the first coat. A second coat can then be applied to the outer surfaces after assembling.

TO SET UP THE BIRD BATH, drive a tapered stake 24 inches long (Fig. 192) 12 inches or so into the ground, slip the pedestal uprights over it and fasten with nails.

PART II

SUMMER OUTDOOR HANDICRAFT

Chapter XI

YOUR CAR FOR THE SOAP BOX DERBY

The All-American Soap Box Derby—Rules and Regulations Governing Cars—Suggestions for Building a Car—The Chassis—The Running Gear—Brakes—The Steering Gear—The Car Body—Comments of a Research Engineer—From Soap Box Cars to Midget Racers

THE ALL-AMERICAN SOAP BOX DERBY is a glorified Pushmobile Race, with this distinction—it is run upon an inclined track, with gravity for motive power instead of upon a level track with boy pushers. Winners of a Soap Box Derby are builders and pilots of the cars. Success is due to their skill alone, while winners of a Pushmobile Race must share honors with the boys who run behind and push. Moreover, Soap Box Derby losers are solely to blame for defeat, since they have built the cars and since there are no faltering, stumbling pushers to hold responsible for poor showing.

The All-American Soap Box Derby has been cosponsored for a number of years by the Chevrolet Motor Division, General Motors Sales Corporation, and more than one hundred American and several foreign newspapers. Local races have been held each July to determine entrants for the National finals held in Akron, Ohio, in mid-August. Prizes have been donated by local merchants. National prizes have been awarded by the Chevrolet Motor

Company, and have consisted of a $2,000 scholarship in any recognized state college and two Chevrolet coaches. In addition, to encourage originality, special prizes have been awarded for (a) the best designed car, (b) the best designed brakes, (c) the best upholstered job and (d) the fastest heat. Winners of the latter awards have been boys of more than average ability in designing and building.

Photographs Figs. 193 to 196, in the book frontispiece, show the start, progress and finish of an All-American Soap Box Derby, and give an idea of the thousands of spectators who line the course. These pictures should set your blood a-tingling and inspire you to build a racer. Possibly your local newspaper and Chevrolet dealer have not sponsored a Soap Box Derby, but they might do so if enough of you fellows were to approach them and show them the Derby program presented in this chapter.

After examining many cars entered in Soap Box Derbies, I have been impressed with the fact that there has been no radical change in chassis construction from that used in pushmobiles over a long period of years; indeed, there has been little or no deviation from the plans included in my handicraft books published in 1912 and subsequent years, and it is a satisfaction to know that builders of the All-American Soap Box Derby cars the country over have had access to these books in school, home and public libraries.

Figures 197 to 199 on the opposite page show a number of car models that I photographed at one of the annual classics. They will give you ideas for your

FIG. 197. A SOAP BOX DERBY PARKING LOT

FIG. 198. CARS THAT HAVE HUNG UP GOOD RECORDS

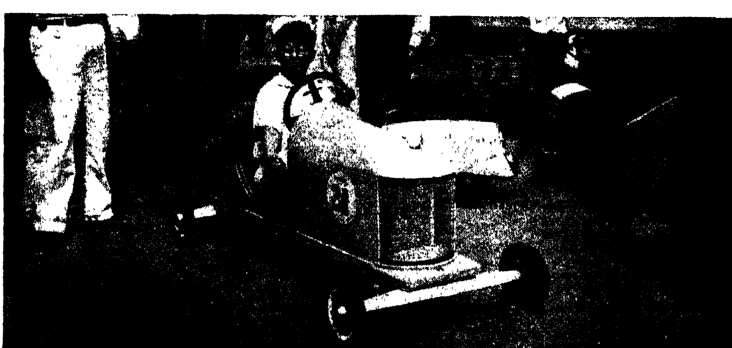


FIG. 199. A CAR WITH CLASS AS WELL AS SPEED

car, but before making any plans study carefully the following

RULES AND REGULATIONS GOVERNING CARS

Rules were found necessary to regulate the size of cars, cost, the choice of materials and methods of construction, for naturally such developments as wheels with special bearings, speed accelerators, the welding and brazing of parts, and other gadgets and assembly methods, injected into the construction by older heads, had to be ruled out, lest they establish a trend toward super types of cars that the average boy with limited shop equipment and experience could not compete with.

RULE NO. 1

Boy Built. The Soap Box Derby is strictly a boys' event and the entire construction must be done by the boy. The boy can drive only the car which he himself has built.

Materials. Wheels, bearings, tires, axles and steering wheels are the only items that may be used in ready-made form.

With the exception of steering wheels, no automobile parts—steering knuckles, brake drums, steering mechanism, axles, brake rods, tie rods, or cut-down wheels, may be used.

No welding or brazing of any type will be permitted on any car. Cars showing evidence of any

outside assistance, other than advice and instruction, will be disqualified.

Cost. No Car may cost over $10.00 to build.

RULE NO. 2

Wheels and Tires. No car shall have wheels and tires over 12 inches in height (Fig. 200). All wheels

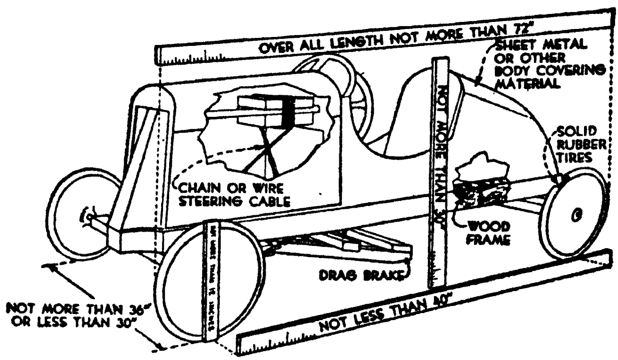


Fig. 200. STANDARD SPECIFICATIONS FOR YOUR RACER
(Figs. 200-213. Courtesy All-American Soap Box Derby)

must be equipped with some form of solid rubber tires. Wheels must be of standard manufacture, or wheels available from baby carriages, wagons, etc. Pneumatic tires are barred. Tire width must not exceed 2 inches.

RULE NO. 3

Number of Wheels. Cars must have four running wheels on the ground—two in the front and

two in the rear. Cars with more or fewer than four wheels will be barred.

RULE NO. 4

WHEEL TREADS. No car shall have front or rear wheel treads of less than 30 inches or more than 36 inches. The tread is the distance from the center line of one tire to the center line of the opposite tire, measured on the ground (Fig. 200). Front and rear treads need not be the same.

RULE NO. 5

HEIGHT OF CAR. The over-all height of the car shall not be greater than 30 inches (Fig. 200). The steering wheel only may extend above the height allowed for the car.

RULE NO. 6

WHEEL BASE. The wheel base shall not be less than 40 inches. The wheel base is the distance from the center of the front wheel to the center of the rear wheel, on the same line of the car (Fig. 200).

RULE NO. 7

WIDTH OF CAR. The over-all width of the car shall not exceed 42 inches.

RULE NO. 8

Length of Car. The over-all length of the car shall not exceed 72 inches.

RULE NO. 9

Driver. No car shall carry more than one boy. Driver must sit up to steer the car.

RULE NO. 10

Steering Wheel. All cars must be steered with a steering wheel. A steering wheel must have a complete rim of rigid material and at least three spokes. The hub must be securely and rigidly fastened to the shaft upon which it is mounted. The shaft must be mounted firmly in the car and the steering cables must be taut.

Steering cables from posts to axles must be either of chain or wire cable. Rope is barred. No soldering may be used in attaching chain or wire cables.

All steering equipment must withstand rigid inspection by the Chief Inspector.

RULE NO. 11

Brakes. All cars must be equipped with a brake or brakes capable of stopping the car with safety. Only two types of brake devices will be permitted,

and they must be operated either by hand or by foot. The two types are *drag brakes* and *wheel brakes.*

If one drag brake is used, it must be constructed in the center of the car. If double drag brakes are used, one drag must be on each side of the car. If wheel brakes are used, one must be installed on each rear wheel.

One side drag brake or one wheel brake will not be permitted.

RULE NO. 12

GADGETS. All attachments, such as decorations, pennants, insignia, lights, ornaments, etc., must be securely fastened to the car. No glass will be permitted on the car. Officials may remove any attachment, including spare tire, which may in their opinion prove dangerous to drivers or spectators.

RULE NO. 13

CONSTRUCTION. The frame and body of the car must be constructed of wood. Tin, sheet metal, fabric or wood may be used as a body covering. There must be no exposed rough or sharp edges. All edges around the driver's cockpit must be padded or otherwise protected.

No automobile parts, except steering wheel, will be permitted in the construction of the car. Necessary hardware, such as pulleys, turnbuckles, nails and screws, may be used.

The car must not be loaded with loose or concealed weight such as lead, sand, iron, bricks, water, cement, etc. All weight in the car must be a part of the car and must be built into it.

RULE NO. 14

WEIGHT. The car and driver in any class must not weigh over 250 pounds. The weight will be computed by the total weight of the boy and the car.

RULE NO. 15

BEARINGS. The car may be equipped with plain, roller, or ball bearings. No distinction will be made between them.

RULE NO. 16

STARTING DEVICES BARRED. The car shall have no attachment which will in any way aid in the starting of a car or increase its speed while running.

RULE NO. 17

CLASSIFICATION. Drivers will be classified according to ages. Class A—ages 13 to 15, inclusive. Class B—ages 9 to 12, inclusive. Ages will be computed as of the day of the local race, and this age classification will hold up to and including the final race for determining the National Champion. Boys

16 years of age, or under 9, will not be permitted to race. Former city champions will not be eligible.

RULE NO. 18

RACE PROCEDURE. Races will be run on a heat elimination basis.

A. Heats of class drivers, winners to quarter-finals.
B. Quarter-finals, winners to semi-finals.
C. Semi-finals, winners to class final.
D. Final.

Racing cars will start from a standing start or from a stationary position on a special starting ramp (depending on local track conditions) with no additional help. No pushing will be allowed.

RULE NO. 19

INSPECTION. All racing cars must be inspected at the official inspection station.

RULE NO. 20

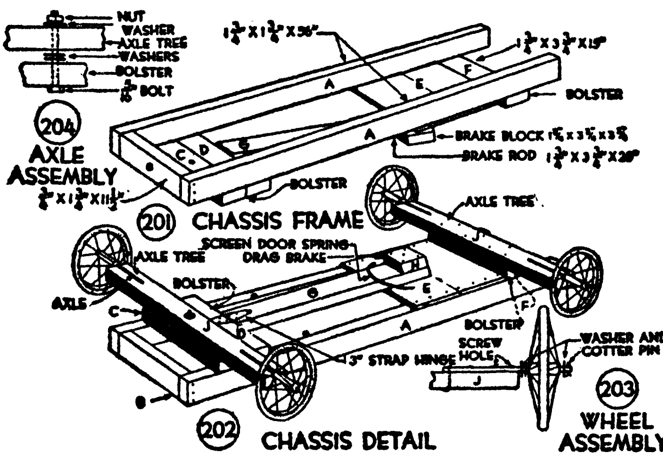
OFFICIALS. Officials will reserve the right to disqualify the driver or car which in their opinion may prove dangerous to the driver, other drivers, or spectators.

Officials will reserve the right to disqualify any driver who displays poor sportsmanship.

The decision of officials in all matters will be final.

SUGGESTIONS FOR BUILDING A CAR

A number of practical suggestions for building a car that will qualify for entrance in a Soap Box Derby are given on the following pages. These have



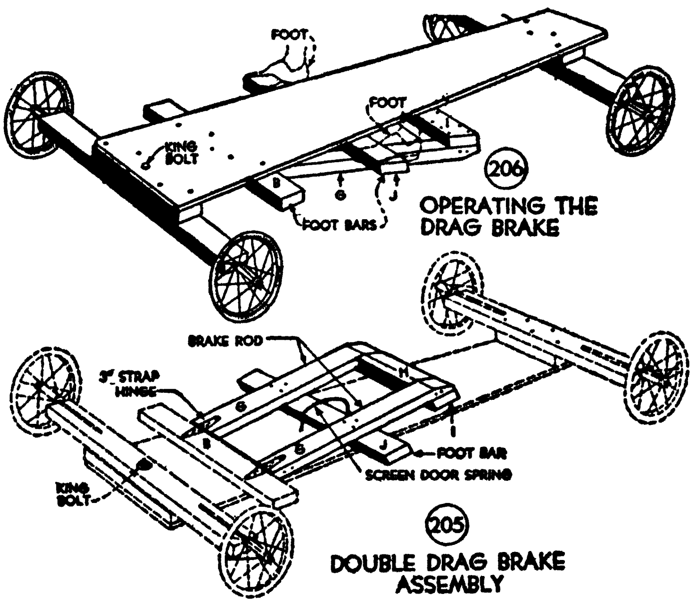
FIGS. 201-204. DETAILS OF CHASSIS

been collected by the technical committee of the All-American Soap Box Derby after studying the good points embodied in thousands of Derby cars. They are presented together with working details Figs. 200 to 213 reproduced, with permission, from the official rule book. I also refer you to the chapters on pushmobiles in my other handicraft books.

THE CHASSIS

THE CHASSIS FRAME must be of wood. A suggestion for its construction, with dimensions for its mem-

bers, is given in Fig. 201. Side rails A are joined at the front by rail B, spiked between the ends, and by axle bolsters C, D and F, nailed across them. Seat E is also nailed across the rails.



FIGS. 205-206. DETAILS OF DOUBLE DRAG BRAKE

Instead of building the frame, you may use a board 12 inches wide and 60 inches long, like that shown in Fig. 206. This will make the side rails unnecessary. Foot rail B is fastened 11 inches from the front end.

THE RUNNING GEAR

WHEEL AXLES should be obtained with the wagon wheels or other wheels, if possible. If you cannot

get them, make a pair out of steel rod. In Fig. 202 the axles are 15 inches long. They are threaded on one end for nuts, or drilled for a cotter pin (Fig. 203), and drilled for screws or staples for fastening to 2-by-4 *axle trees* 30 inches long (J, Fig. 202).

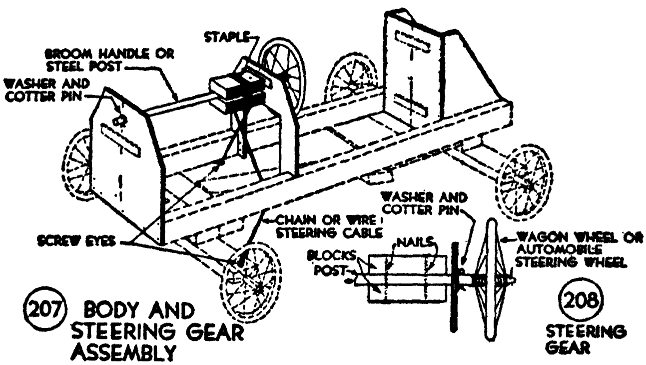
The front axle tree must be pivoted to turn. Bolt it to the bolster with bolt, nut and washers placed as in detail Fig. 204. It is a good idea to drill a hole through the threaded end of the bolt for a cotter pin to prevent the nut from working off. The rear axle tree is spiked or screwed to the rear bolster.

Drag brakes are simpler to install than wheel brakes, and they are more dependable.

The single drag brake in Figs. 201 and 202 consists of a brake rod (G) hinged to bolster D with a 3-inch strap hinge, and a brake block (H) nailed to the end of the rod. A screen door spring looped over the rod and stapled to the seat board, holds the brake block above the pavement and springs it back into position each time that the brake is released. Fasten the spring so that it holds the brake block about 3 inches above the pavement when released.

The double drag brake in Figs. 205 and 206 is built of 2-by-4 rods (G) 28 inches long with the free ends beveled and a brake block (H) shaped to fit between them, a 2-by-4 bar (I) spiked to the upper face of the brake block, and a 2-by-4 footbar (J) 23 inches long centered upon the rods. Pivot the brake rods to footbar B with 3-inch strap hinges. Loop a screen-door spring over the center of footbar J, and staple its ends, as shown, for the release action of the brake. Dotted lines in Fig. 206 indicate how both

feet pressed upon the footbar throw on the double drag brake.



FIGS. 207-208. DETAILS OF BODY AND STEERING GEAR

Drag brakes are more positive in operation than wheel brakes, and bring the car to a smooth stop. They are on the cars shown in Figs. 207 and 209.

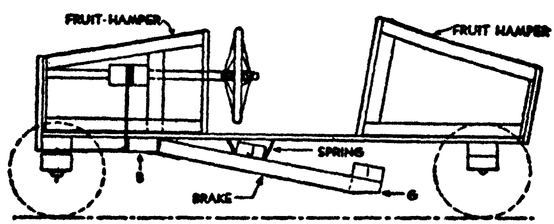


FIG. 209. SIDE VIEW OF ASSEMBLED CAR

THE STEERING GEAR

The steering gear is next in importance to the running gear, and it should be planned and installed with care. Details are shown in Figs. 207 to 211.

THE WHEEL may be a wagon wheel but an automobile wheel is easier to handle and it looks better.

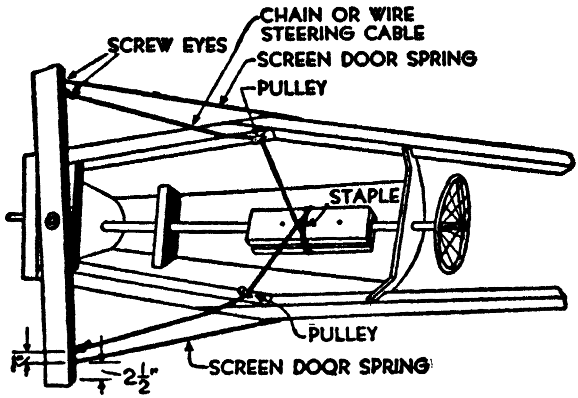


FIG. 210. DETAIL OF STEERING GEAR SHOWN FROM BELOW

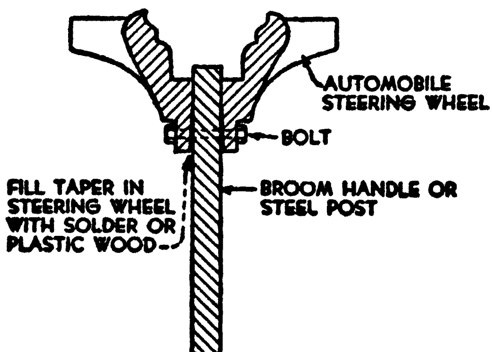


FIG. 211. POST FOR MOUNTING AUTOMOBILE STEERING WHEEL

THE POST may be a broom handle tapered at one end to fit the hub of the wagon wheel (Fig. 208). If you use an automobile wheel, attach the handle with a bolt as shown in Fig. 211. A steel rod is a much

better post than a broom handle and it will cost little. The post should run through holes bored in the body cowling and radiator front (Figs. 207, 209 and 212). Therefore, the car body must be built before you install the wheel and post. Cotter pins in holes drilled through the post will hold it in place.

THE STEERING CABLE requires a chain or wire cable about 7 feet long, two pulleys, two screen-door springs, screw eyes or staples, and two wooden blocks (Fig. 210).

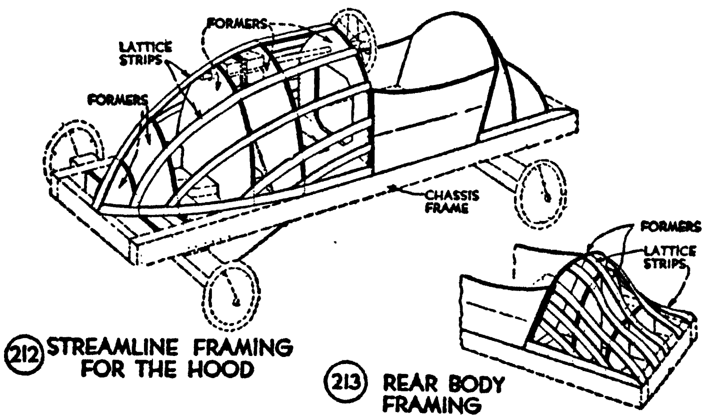
Bolt the blocks to the steering post. They may be of the proportions shown in Figs. 207, 209 or 210. Screw the pulleys to the chassis rails. Fasten the center of the length of chain or wire cable to one of the steering post blocks, make two turns around the blocks, run the ends down to and through the pulleys, and fasten to screw eyes driven into the axle-tree (Fig. 210). Attach the screen-door springs to screw eyes or staples driven into the axle trees and chassis frame. They stiffen the action of the wheel, but also help to hold the car to the road. Much of the success of the steering gear depends upon a careful adjustment of parts.

THE CAR BODY

THE DESIGN. You have wider latitude in designing the car body than the chassis, though you are limited to wood for its construction, with wood, tin, sheet metal or fabric for covering material. A va-

riety of designs are shown in the photographs. A simple design is shown in Figs. 212 and 213.

THE HOOD may have a cowling and radiator front built up of ¾-inch boards shaped as shown in Fig. 207, or it may be streamlined with a framing of lattice strips bent over formers as shown in Fig. 212. The smoothness of the covering will depend upon the



FIGS. 212-213. DETAILS OF BODY FRAMING

job of framing. Some of the cruder cars have hoods made of fruit hampers, others have hoods framed and covered with boards from fruit crates. The best looking models are covered with metal and finished with automobile enamel. Canvas attached dry, then wet and shrunk makes a tight fitting covering.

THE REAR END may be built of boards (Fig. 207), a fruit hamper (Fig. 209), or lattice strips shaped over formers (Fig. 213).

THE SEAT may be built of rough boards, since it should be padded, then covered with upholstering

material. Spare neither time nor effort in finishing the seat. A well built car is worthy of the best job of upholstering you are capable of producing, and you may be rewarded with a Derby prize for workmanship.

COMMENTS OF A RESEARCH ENGINEER

In an interview with a representative of *Popular Mechanics Magazine*, Charles F. Kettering, Vice President in charge of research, of General Motors Corporation, said: "I believe every Soap Box Derby entrant who carefully follows the rules, who designs and builds his own car, who studies how to get the best performance out of his car, and who conducts himself in every race in a sportsmanlike manner, is a better boy after the race—win or lose—and will grow to be a better citizen by applying the lessons of the contest to his every-day life.

"My opinion is that the thing most essential to building a good soap box car is brains—and that includes ingenuity and resourcefulness and, especially, what is known as common sense.

"Any boy can build a four-wheel coaster that can be steered—and that is all that is required of a soap box car, subject to rules regulating safety, size and weight. But everything depends on the boy's original plan for the car, and on his careful workmanship.

"If I had had the chance to compete in these races when I was a boy, I would have proceeded just as I have always done in carrying out other projects—in developing the self starter, for example. The first

thing is to learn what a soap box car must be and what it must not be. The next step is to consider advantages and disadvantages of different possible types of car—judged by cost, materials available, ease of construction and performance. Rough

FIG. 214. CARTOONIST THOMAS, IN DETROIT NEWS, SHOWS AN ASSEMBLY LINE

sketches should be made and revised before any work is done. Consideration must be given the materials to be used. Will they make a strong chassis? Will they keep the car inside the weight limit?

"Only when I had finally put a car together would my real work of trying to make it a winner actually commence. That's where the value of the proving ground comes in.

"Suppose my car is designed with the simplest steering gear—a movable front axle, pivoted in the middle, with a wheel at each end. I know much depends on having both wheels aligned to follow exactly parallel courses. I also know that on my first try I may not have succeeded in attaining the correct alignment. The wheels may toe out or toe in imperceptibly, but enough to slow down the car. What do I do? First, I make a series of test runs on a grade, either timing myself or seeing how far the car will coast each time. Then I make the same tests over again—but I first turn the front axle around. If the wheels toed out slightly before, now they toe in—and the car will run better because the road resistance will tend to offset the toe-in."

FROM SOAP BOX CAR TO MIDGET RACERS

If you are ambitious to own a midget racing car some day, learn all you can about the mechanics of soap box cars, in preparation for tackling the motor-powered job.

Chapter XII

PADDLE YOUR OWN KAYAK

A Modified form of Eskimo Kayak—A Speedy Craft, Simple and Inexpensive to Build—The Framework—Assembling the Framework—The Canvas Covering—The Cockpit—Finishing

You will find the modified form of Eskimo kayak in Fig. 215 a speedy little canoe and a simple craft to build. You can knock it together in a day or two after your arrival at the lake and have all vacation to use it. Furthermore, it is an inexpensive job, with framework of pine, spruce, ash or whatever easily worked strong material is available, and a covering of canvas.

THE FRAMEWORK

Figure 216 shows a plan of the framework and Fig. 217 shows a detail of the completed assembly before the canvas has been put on.

THE STEM CONES, shown in Fig. 216, support and hold together the ends of the frame gunwales and ribbands. They are of sheet iron and are alike. Figure 218 shows a detail. Buy a piece of No. 24-gauge galvanized iron at a tinshop and lay out two pieces of the shape and size shown in Fig. 219. Cut them out with tinsnips, drill four ¼-inch holes in the side edges for rivets and drill eight 3/16-inch holes along

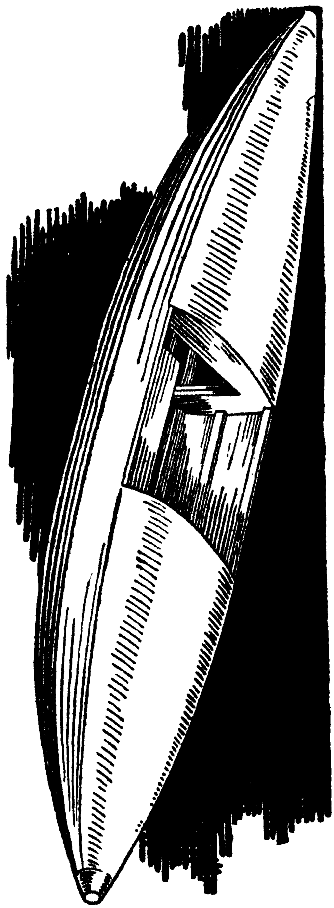
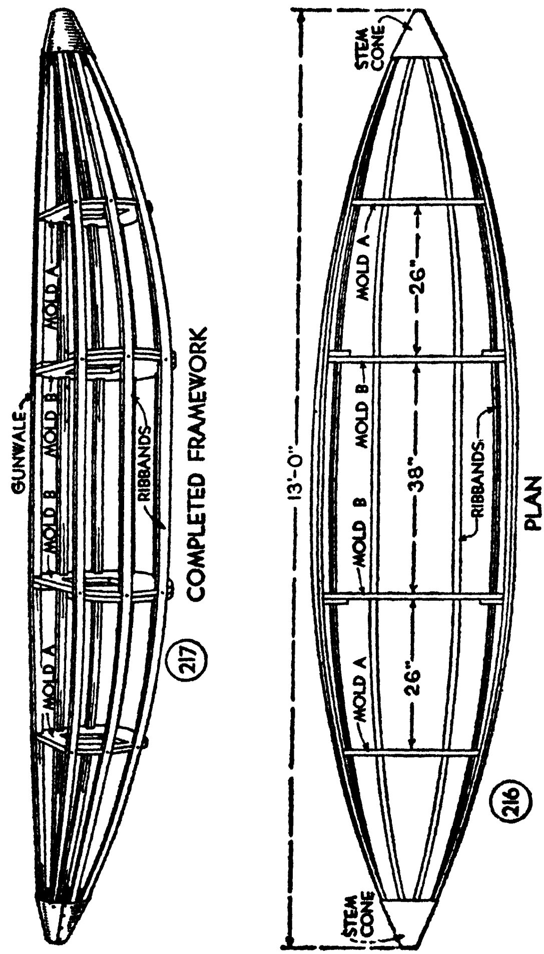


FIG. 215. A MODIFIED FORM OF THE ESKIMO KAYAK



Figs. 216-217. Plan and Detail of the Kayak Framework

the wide edge for bolts. Bend the pieces coneshaped and rivet the edges.

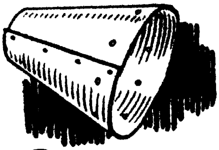
THE GUNWALES AND RIBBANDS. Figure 220 shows the thickness and width to cut the gunwales and ribbands. You can rip them out of a board. Possibly there is a circular saw at the local lumber yard on which you can have the ripping done. Round off two edges of each strip as shown in Fig. 221, to remove their sharpness. This will protect the canvas covering from wear and possible cutting through.

THE MOLDS required to support the gunwales and ribbands between ends are shown in Figs. 222 and 223. Two molds of each size are required. You can cut the smaller pair (A) from a 12-inch board. The larger pair (B) is 15 inches high, and since you may not be able to get a board 15 inches wide, you may have to batten two pieces together as shown in Fig. 223. The center of molds B is cut away to provide leg room.

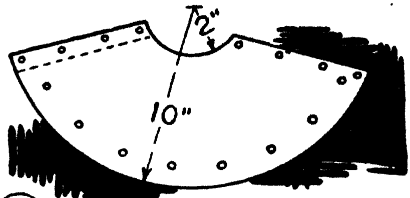
The mold outlines are shown in the diagram of Fig. 224, squared off with each square representing 1 inch of the full-size mold. Make a similar layout with squares that measure 1 inch across and lay out the full-size outlines upon them. When you have laid out and cut the molds, locate the positions of the gunwales and ribbands upon the edges, with equal spacing, and cut notches 1 inch wide and ¾ inch deep.

ASSEMBLING THE FRAMEWORK

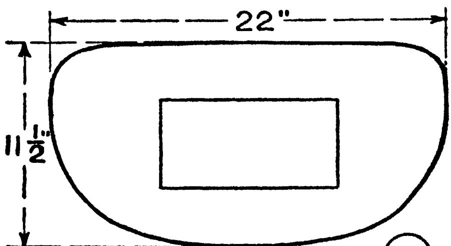
The spacing of the molds in the framework is shown in Fig. 216. Mark off this spacing upon the



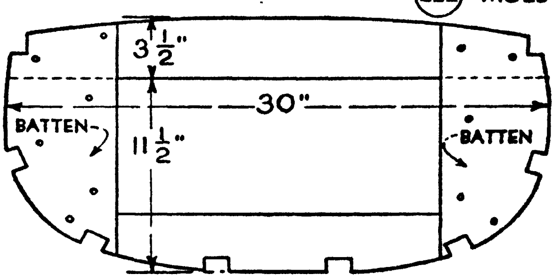
(218) STEM CONE



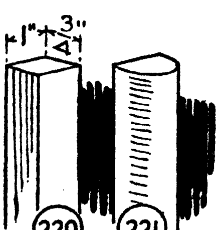
(219) PATTERN FOR CONE



(222) MOLD A



(223) MOLD B

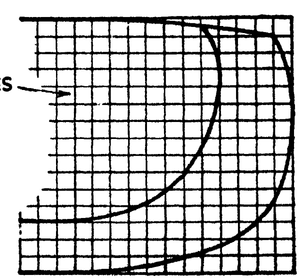


(220) (221)

GUNWALES AND RIBBANDS

1" SQUARES

(224) MOLD PATTERNS



FIGS. 218-219. STEM CONE AND PATTERN
FIGS. 220-221. DETAILS OF GUNWALES AND RIBBANDS
FIGS. 222-224. MOLDS AND PATTERNS FOR LAYING THEM OUT

bottom ribbands, drill 3/16-inch holes through the ribbands at these points, and screw the strips to the molds with 3/16-inch brass screws 1½ inches long. Next, drill and screw the gunwales to the edges of the molds, then the side ribbands. Make the spacing between the gunwales and ribbands equal.

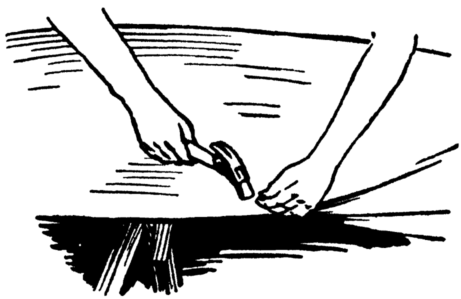


FIG. 225. APPLYING THE CANVAS COVERING

When you bring the ends of the gunwales and ribbands together, you will find trimming necessary to make them fit in the stem cones. Taper the ends just enough to make a neat job. Drill the ends and bolt with 3/16-inch stove bolts.

THE CANVAS COVERING

The covering requires a piece of 8-ounce cotton duck 60 inches wide and 15 feet long, and two pieces 30 inches wide and 6 feet long. Spread the long piece over the bottom from stem to stem and gunwale to gunwale. Tack it along one gunwale with copper tacks, as shown in Fig. 225, then stretch it

taut from that side to the opposite side and tack it to that gunwale. Careful fitting at the stems is necessary to take up the fullness of the material. With the bottom covered, fit and tack the deck pieces in place.

THE COCKPIT

The cockpit of the kayak has no *coaming*, but you may add one if you want to give the craft a trimmer appearance.

Fit boards in the bottom of the cockpit for a floor.

FINISHING THE KAYAK

To finish the job, give all surfaces a coat of shellac, then two coats of lead and oil paint and two coats of spar varnish.

Chapter XIII

A SKIBOARD FOR WATER THRILLS

A Craft for Speed, Stunts, and Water Polo—Riding a Skiboard—The Craft's Construction—Material for Building—The Framework—Assembling—Enclosing the Framework—The Canvas Covering—Trimming—Finishing the Skiboard—An Emergency Switch

YOUR skiboard will be the sensation of the lake. But skiboarding will not be your sport exclusively for long. And so much the better. Cottagers alive to the possibilities of fun will appear with similar craft. Competition will grow keen. New speed and stunt records will be hung up daily. Four piloted skiboards will provide the setting for water polo. Indeed, skiboards will awaken a greater interest in aquatic affairs among young and old than your lake community has experienced in many moons.

RIDING A SKIBOARD

Dick Pope, outboard-motor champion and stunt man extraordinary, demonstrates how to ride a skiboard in photograph Fig. 226, and two teams play a spectacular game of water polo in photograph Fig. 227.

When you have acquired the knack of rising to your feet after starting your outboard motor, not so

difficult as it might seem, there is nothing to riding a skiboard except to maintain a firm hold upon the reins and shoot over the waves, shifting the weight of the body from one leg to the other as a means of steering.

THE CRAFT'S CONSTRUCTION

The simplicity of the craft's construction recommends it as a vacation project. You can build it

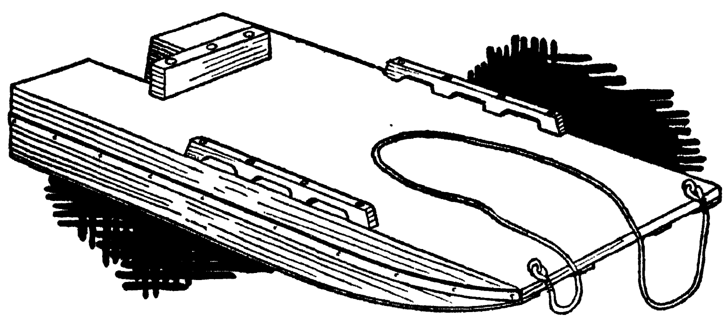


FIG. 228. THE SKIBOARD HAS A BUILT UP FRAMEWORK, WITH PLYWOOD DECK AND BOTTOM, AND STERN RECESSED FOR OUTDOOR MOTOR

away from shop conveniences, but you may prefer to cut the parts to size at home and transport them knocked-down to your lake site for assembling.

Figure 228 shows the completed skiboard, and Fig. 229 shows a detail of the framework assembly. Notice that the craft is built with square bow and stern, and bottom sloping at the bow, like a punt, that the stern is recessed to admit the outboard motor, and that it is decked fore and aft.

FIG. 226. DICK POPE RIDES A SPEEDY SKIBOARD

FIG. 227. WATER POLO PLAYED BY SKIBOARD PILOTS, TWO ON A SIDE, IS PACKED WITH THRILLS

MATERIAL FOR BUILDING

As it is desirable to build the skiboard as light as possible, use cypress, pine, redwood or other light-weight wood. Buy 7/8-inch by 8-inch stock for the sides, stern pieces, stretchers, deck beams and hand rails. This usually runs less than 7/8 inch thick. I have indicated 3/4 inch on the details. Buy a 2-by-4

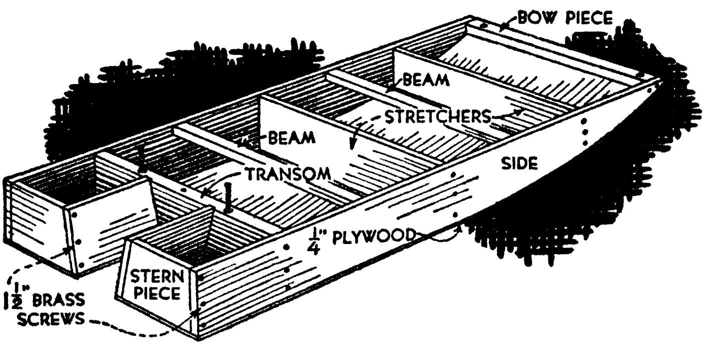


FIG. 229. DETAIL OF SKIBOARD ASSEMBLY

out of which to shape the bow piece and transom piece B, and a 2-by-8 from which to cut transom piece A. Buy 1/4-inch plywood for the bottom and the deck. The plywood should be of waterproof glue construction since it will become wet if the canvas covering is accidentally torn, which will happen sooner or later.

THE FRAMEWORK

THE SIDE BOARDS require a pattern laid out as shown in Fig. 230. The printed pattern is squared

off at the bow to assist you in laying out the curve upon your full-size pattern. After preparing the pattern and transferring it to your working material, rip out the two side boards and smooth the sawed edges. Then lay off the spacing for the stretchers and transom by the dimensions in Fig. 230, and scribe lines across the pieces as indicated.

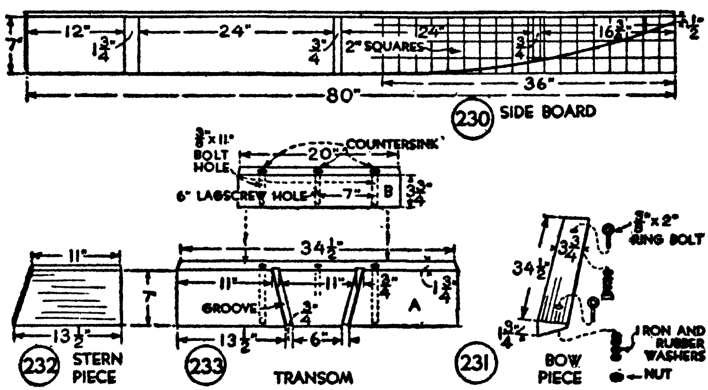


FIG. 230. PATTERN FOR SIDE BOARD
FIGS. 231-232. DETAILS OF BOW AND STERN PIECES
FIG. 233. DETAILS OF TRANSOM

SHAPE THE BOW PIECE as shown in Fig. 231. The bevel of the lower surface should match the curve of the side boards. Take it from pattern Fig. 230.

CUT TWO STERN PIECES of the size shown in Fig. 232, out of ⅞-inch stock.

CUT TRANSOM PIECES A and B of the sizes shown in Fig. 233, out of 1¾-inch stock. Groove piece A as shown to provide for letting the sides of the motor recess into it. Cut the grooves ¼ inch deep. Cut the two stretchers of the length of the transom.

ASSEMBLING

Use flat-headed brass screws 3/16 inch in diameter and 1½ or 1¾ inches long for assembling the skiboard framework. Fasten the bow piece, transom and stretchers between the side boards. Then fasten the stern pieces to the ends of the side boards. Complete the framing for the motor recess by cutting pieces to extend from the stern pieces to the grooves in the transom. Cut the two deck beams 2 inches wide and fasten them between the side boards for additional deck supports, as shown in Fig. 229.

ENCLOSING THE FRAMEWORK

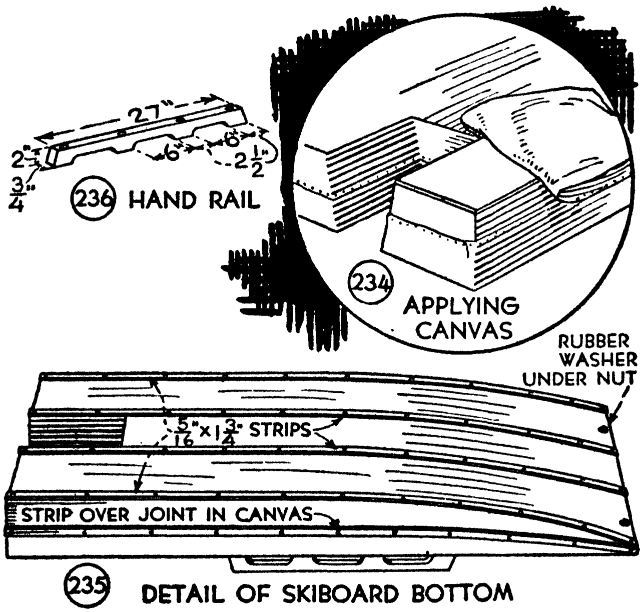
Apply the plywood to the bottom first. Buy flat-headed brass screws ¾ inch long for fastening it. Invert the frame and coat the edges with casein waterproof glue. Screw the plywood to the bow piece, placing the screws 1½ inches apart. Apply clamps to the edges of the side boards, stretchers, transom and stern recess framing, then nail them. Trim the edges of the plywood flush with the frame and cut away for the motor recess. Right the bottomed frame and apply the deck plywood.

THE CANVAS COVERING

Use an 8-ounce cotton duck for covering the skiboard. You will need 5 yards of material 44 inches

wide. Buy marine glue and copper tacks for fastening it.

Apply the canvas to the hull bottom first. Coat the surfaces with the glue as directed on the package,



FIGS. 234-235. COVERING AND TRIMMING THE SKIBOARD BOTTOM
FIG. 236. DETAIL OF HAND RAIL

then spread the canvas so that its edges lap 4 inches over the sides as indicated in Fig. 234. Tack along the stern and stretch it tightly from stern to bow. Place the copper tacks along the canvas edges 1 inch apart. Cut and turn in the canvas neatly at the corners. Figure 234 shows the canvas fitted around the recessed stern.

Apply the glue to the deck and side surfaces, bring the canvas up over the bow, stretch it tightly and tack its edges over the bottom laps. These edges should lap about 1 inch over the bottom laps.

After completing the covering, run a hot iron over the surfaces, as directed in the glue manufacturer's instructions, to draw the glue up into the canvas fabric.

TRIMMING

Trim the skiboard with lattice strips. Run one strip over the side canvas laps, as shown in Fig. 235, and fasten it with round-headed brass screws. Fasten four strips to the bottom from bow to stern, as shown, to protect the canvas from wear. Bolt upper transom block B in position.

PILOT REINS. Use sash cord for reins. Fasten the rein ring bolts through the bow, run the sash cord through the eyes and make neat eye splices.

THE HAND RAILS are shown in detail in Fig. 236. Screw them down at the sides of the deck with round-headed brass screws.

FINISHING THE SKIBOARD

Give the canvas surfaces a coat of lead and oil paint, and one or two coats of enamel, and either shellac and varnish the wood trim or give it two coats of enamel of a color contrasting with that used for the canvas.

AN EMERGENCY SWITCH

As a provision for emergencies, it is a good plan to install a switch with which the pilot may shut off the motor with the pull of a cord.

Chapter XIV

AN AQUAPLANE

A Worth-While Addition to your Water Craft—An Excellent Shallow Water Raft—Selecting the Stock—Laying Out the Stock —Assembling—Shaping the Bow—Canvas Covering and Finishing—Reins and Towline

A WATER sled like that described in this chapter, built upon the lines of a surfboard, is a worth-while

FIG. 237. AQUAPLANING IN TOW OF A MOTOR BOAT

addition to your water craft. You will use it for aquaplaning in tow of a motor boat, as shown in the

sketch of Fig. 237 and photograph Fig. 243, and the younger children on the beach will find it an excellent shallow water raft.

SELECTING THE STOCK

The aquaplane is a simple craft to build. Figure 238 shows the completed job, Fig. 240 shows a plan

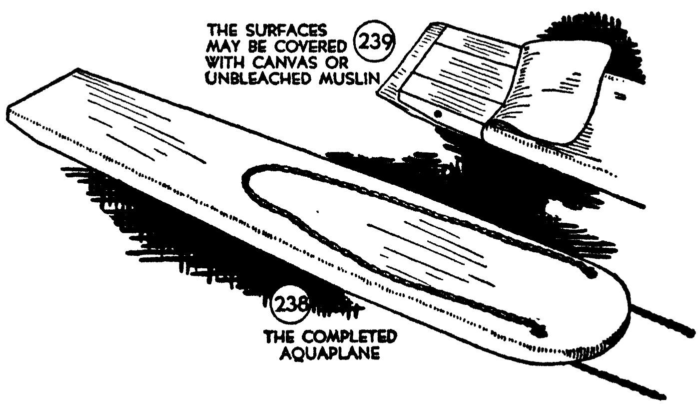


FIG. 238. DETAIL OF COMPLETED AQUAPLANE
FIG. 239. COVERING THE SURFACE WITH CANVAS

and Fig. 241 an edge. The best material for the job is *balsa* because of its light weight. The local lumber dealer may not carry it, but he can get it for you. Redwood, cedar or pine is second choice. The stock should be 2½ inches thick and you will need three 8-inch planks 10 feet long. If you cannot get stock 2½ inches thick, use thinner stock lapped to make it two ply. California redwood is available in wide planks and if you can get a plank 22 inches wide it will save joining and simplify the work.

Courtesy "Outboard Motor Corp."

FIG. 243. AQUAPLANING TO THE CALL OF A SIREN

Courtesy "Warner Bros. Studios"

FIG. 244. OLIVIA DE HAVILLAND, MOVING PICTURE STAR, AND HER SURF-BOARD SAILBOAT (see Chapter XV)

LAYING OUT THE STOCK

If you build the aquaplane of three planks, as shown in Fig. 240, lay out the first and third planks with outer edges straight for a distance of 48 inches and tapered from that point to the stern, so that the assembled job will measure 22 inches forward and 16 inches wide at the stern. Rip the planks to the line of the taper.

ASSEMBLING

You may assemble the planks with 3/8-inch iron rods threaded for nuts, as indicated in Figs. 240 and 241, or cleat them upon the under side with the cleats set into grooves and screwed in place (Fig. 242). You can get the iron rods at a blacksmith's shop, or hardware store, and have them cut to the required lengths and their ends threaded. Locate the rod holes by the given dimensions and scribe center lines across both edges of each plank. Care must be taken not only to locate the holes accurately but to bore them straight. Enlarge them on the outer edges to a depth of 3/4 inch so that you can countersink the washers and nuts.

To ASSEMBLE, screw a nut onto one end of each rod and add a washer. Drive the rods through the holes in the planks, brush waterproof glue upon the inside edges, drive the planks together, add the washers and nuts to the opposite rod ends and turn

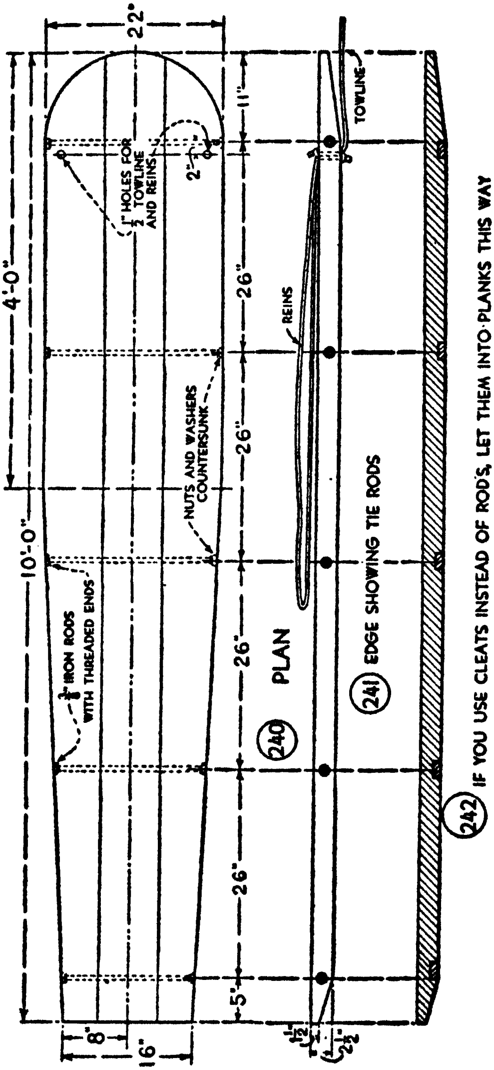


FIG. 240. PLAN OF AQUAPLANE

FIG. 241. EDGE VIEW SHOWING USE OF TIE RODS

FIG. 242. SECTION SHOWING CLEATS SUBSTITUTED FOR TIE RODS

the nuts until the planks have been drawn close together. Cut off the rod ends even with the nuts.

SHAPING THE BOW

With the planks assembled, describe a circle with 11 inches radius upon the bow, and trim off the planks to this line. Round off the corners of the stern and bevel off both the bow and stern upon the under side, as shown in Fig. 241.

CANVAS COVERING AND FINISHING

You can finish the aquaplane with two coats of spar varnish or enamel and call it a job, or you can cover the surfaces with canvas or unbleached muslin as you would cover a canoe (Fig. 239). Use marine waterproof glue or adhesive. Follow the container directions for applying the glue and covering material. Several coats of spar varnish will complete the work.

REINS AND TOWLINE

Use ½-inch rope for reins and towline. Run this through two pairs of holes bored at the points located on Figs. 240 and 241 and knot the ends as shown in Fig. 241, to keep them from pulling through.

Chapter XV

A SURFBOARD FOR SAILING

The Versatility of Surfboards—The Type Needed for Sailing—The Framework—Assembling—Sheathing the Framework—The Mast Step—The Centerboard and Its Pocket—The Canvas Covering—Finishing—Trim and Hardware

You can have a whale of a good time with one of the several types of surfboards developed in Hawaiian waters, made famous by exploitation at Waikiki Beach, and now found everywhere along the beaches of the Pacific and Atlantic, and, indeed, inland on the Great Lakes and smaller bodies of water. Its use is not confined to riding the waves and stunting. A popular diversion is paddling. Lying prone upon one of the lighter surfboards, and using only your arms and hands, you can paddle swiftly over the water, at a speed of one hundred yards in thirty seconds. You can do seven miles an hour. Ease of handling has made the craft invaluable as an adjunct to life-boat rescue work. You can also propel the surfboard with a canoe paddle, but there will be many an upset until you have acquired the skill of balancing while plying the paddle. Paddle races are great sport. With a motor boat to tow you, you can aquaplane freeboard, which is aquaplaning with the tow rope held in the hands instead of attached to the bow. Then there is the sport of sailing with a rigged surfboard.

THE TYPE NEEDED FOR SAILING

Photograph Fig. 244 shows Olivia de Havilland, moving picture star, piloting a rigged surfboard.

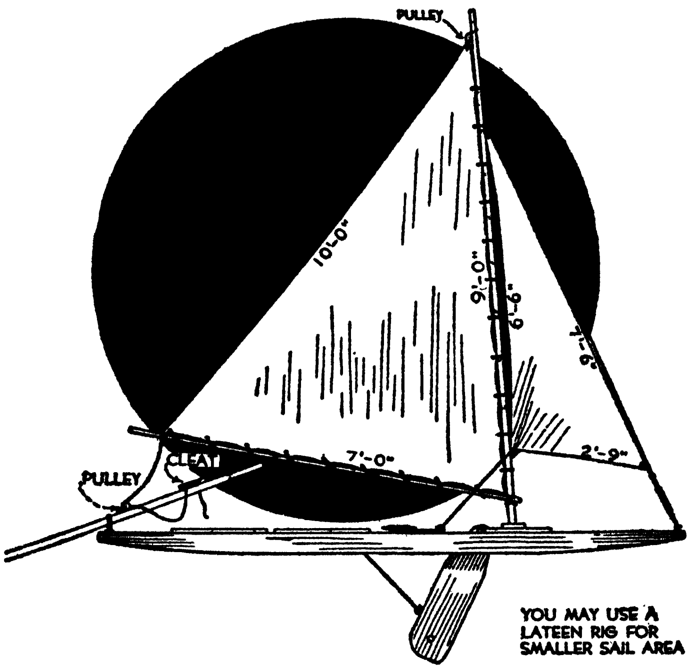


FIG. 245. DETAIL OF RIGGED SURFBOARD SHOWN IN PHOTOGRAPH FIG. 244

This is not the lightweight type of surfboard with pointed stern, designed for speed and foot steering. It has been built with a centerboard to make a large sail possible. The rigging can be modified to meet

your own specifications. The sail area might well be reduced. A catboat rig might be substituted, and a lateen sail would be a good rig for so small a craft.

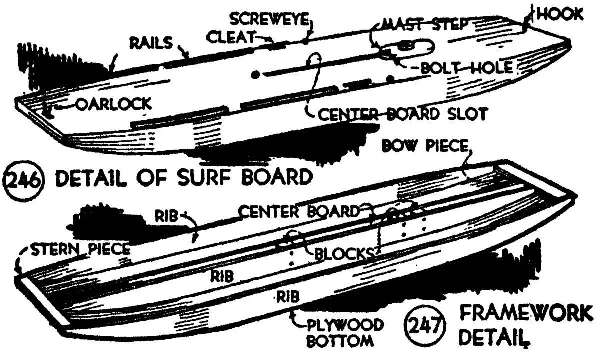


FIG. 246. DETAIL OF SURFBOARD
FIG. 247. FRAMEWORK DETAIL

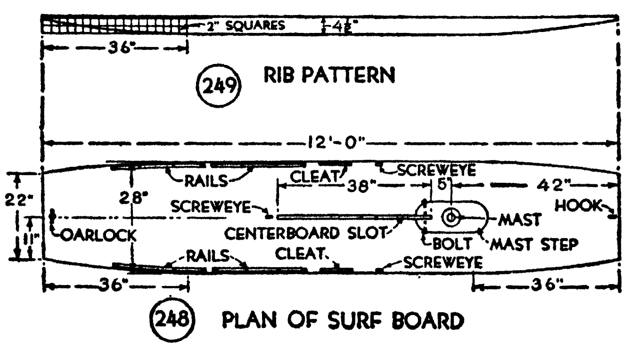


FIG. 248. PLAN OF SURFBOARD
FIG. 249. RIB PATTERN

Figure 245 shows a detail of the surfboard rigged as in the photograph; Fig. 246 shows a detail of the completed surfboard, Fig. 247 a framework detail and Fig. 248 a plan.

THE FRAMEWORK

The framework of the surfboard consists of four ribs and a bow and a stern piece.

A RIB PATTERN is given in Fig. 249.

CUT THE BOW AND STERN PIECES from a 2-by-4. The bevel of the bottom face will be determined by the rib taper. Make the length 20½ inches.

ASSEMBLING

To assemble the framework, first fasten the center ribs between the bow and stern pieces 1¼ inches apart. Use galvanized or cement-coated nails. The side ribs parallel the center ribs, with a beam measurement of 28 inches, to a point 36 inches from the bow and stern, then they are bent to meet the bow and stern pieces. Set in temporary *molds* between the ribs at the points of bending.

SHEATHING THE FRAMEWORK

Cover the bottom of the framework with ¼-inch waterproof plywood. Coat the frame edges with waterproof glue. Cut blocks to fit between the center ribs, each side of the mast pocket and at the end of the centerboard pocket, as shown in Figs. 247 and 251, and nail the ribs to them. Cut a slot through the bottom of the centerboard pocket.

With the bottom sheathed, remove the temporary molds, cover the deck with plywood and cut the centerboard slot and mast hole through it.

THE MAST STEP

Figure 250 shows a detail of the mast step. Round its ends, slot the aft end to admit the neck of the centerboard and bore a hole for a bolt pivot.

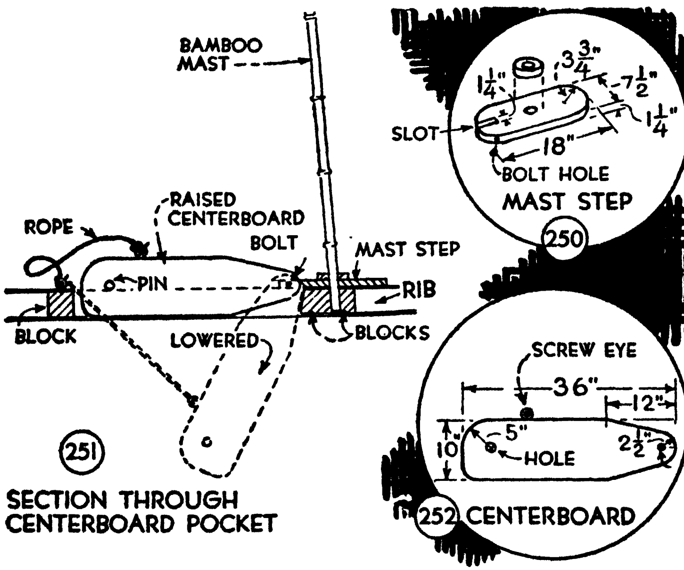


FIG. 250. DETAIL OF MAST STEP
FIG. 251. SECTION THROUGH CENTERBOARD POCKET
FIG. 252. DETAIL OF CENTERBOARD

THE CENTERBOARD AND ITS POCKET

Figure 251 shows a detail of the centerboard and its pocket.

CUT THE CENTERBOARD of the shape and size shown

in Fig. 252, out of 1¼-inch stock. Bore a hole for a ½-inch carriage-bolt pivot and another for a wooden pin. Bolt the centerboard to the slotted end of the mast step and attach a piece of sash cord to screw eyes screwed into the edge of the board and the deck, as shown in Fig. 251.

A PIN. Cut a wooden pin to slip through the board to hold the centerboard in its raised position.

THE CANVAS COVERING

Figure 246 indicates the canvas covering. Apply this with waterproof marine glue, as described for the covering of the skiboard in Chapter XIII.

FINISHING, TRIM AND HARDWARE

THE TRIM AND HARDWARE are shown in Fig. 246. Before attaching this, finish the surfaces of the surfboard with a coat of shellac and several coats of spar enamel.

Chapter XVI

LEEBOARDS FOR A CANOE

Leeboards a Safety Measure—Essential for a Canoe Rigged with a Sail—The Material to Use—Shaping the Leeboards—The Adjustable Thwart—Assembling—Attaching and Adjusting the Leeboards—Finishing

NONE of you is so unwise, I hope, as to venture forth in a canoe unless you can swim. But, granted

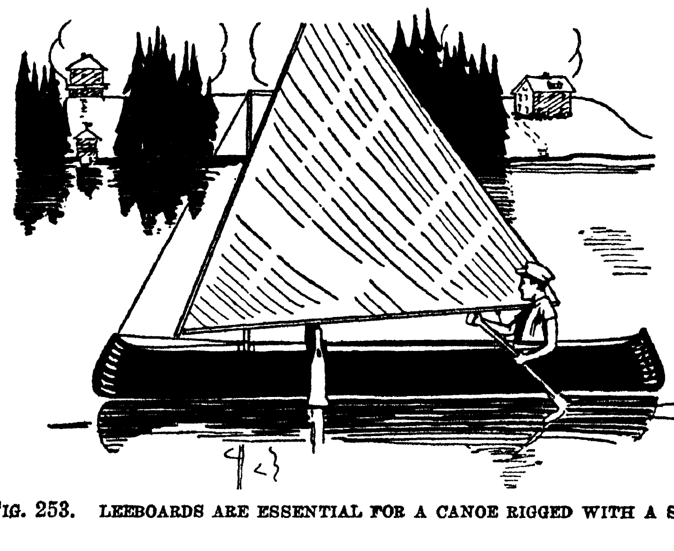


FIG. 253. LEEBOARDS ARE ESSENTIAL FOR A CANOE RIGGED WITH A SAIL

that you can handle yourself in a spill, it is well to equip your canoe with a pair of leeboards. They are essential, of course, if you rig your canoe with a sail.

Only one leeboard is used at a time, usually, on

the leeward side of the canoe, or side opposite to that from which the wind is blowing. But they are assembled in pairs and pivoted so that each may be lowered or raised at will. They are easily and quickly adjusted for shallow water.

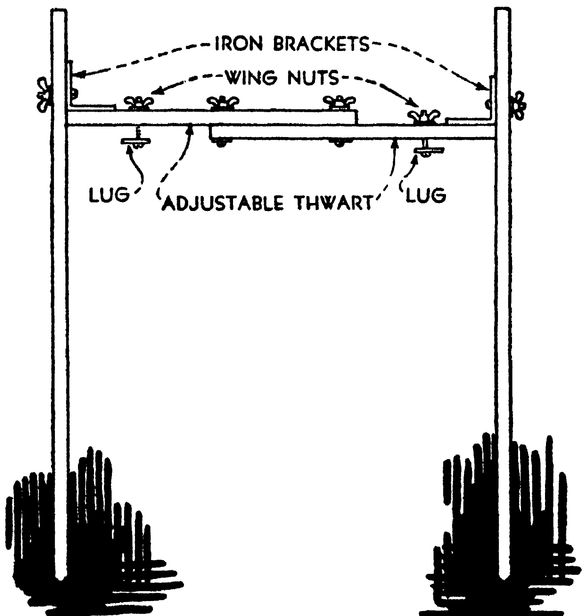


FIG. 254. LEEBOARDS AND THWARTS ASSEMBLED

THE MATERIAL TO USE

Figure 253 shows a lateen-rigged canoe equipped with homemade leeboards. Figure 254 shows a detail of the assembled parts.

Cypress is a good material for the job, but any

other kind of wood that is easy to shape will serve the purpose. Buy stock ¾ inch thick.

SHAPING THE LEEBOARDS

Follow the pattern of Fig. 255 for laying out the leeboards. Opposite edges should be alike, and the easiest way to get them alike is to draw a center line upon wrapping paper, and lay out a half pattern on one side of the line. Then cut out the pattern

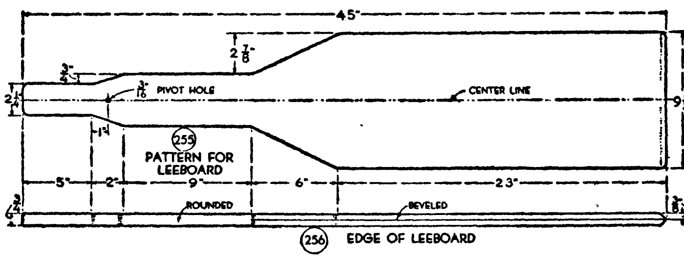


FIG. 255. PATTERN FOR LEEBOARD
FIG. 256. EDGE OF LEEBOARD

and mark around it on each side of center lines drawn upon the working material. Bore a 3/16-inch hole through the upper part of the boards, where located in Fig. 255, for a pivot bolt. Cut the pieces with a small saw, then round the handle edges and bevel the blade edges (Fig. 256).

THE ADJUSTABLE THWART

Figure 257 shows a detail of the adjustable thwart to which the leeboards are bolted.

THE THWART BARS are of equal size. Figures 258

and 259 are patterns. Cut a slot along the center for the length adjustment, and bore two ³⁄₁₆-inch holes for bolts in the positions located. To cut the slot, bore a hole at each end of the space marked off, then cut out the piece between the holes with a coping saw or keyhole saw, or, bore a series of holes in the

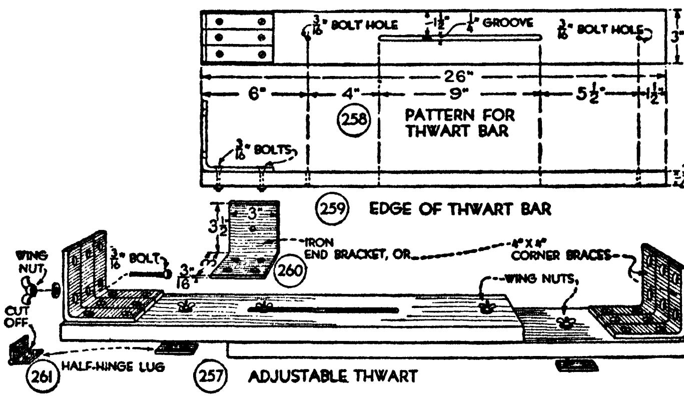


FIG. 257. ADJUSTABLE THWART
FIG. 258. PATTERN FOR THWART BAR
FIG. 259. EDGE OF BAR
FIGS. 260-261. END BRACKET AND LUG

space and split out the wood between the holes with a chisel.

THE END BRACKETS may be made of the dimensions shown in Fig. 260. You can have them shaped at a blacksmith's shop. But it will be cheaper and possibly more convenient to use corner braces, as shown in Fig. 257. Buy half a dozen 4-by-4 corner braces and bolt three to the outer end of each bar, side by side, with ³⁄₁₆-inch stove bolts (Fig. 259). The leeboards are to be bolted with ³⁄₁₆-inch bolts through

the second hole of the center corner brace, as indicated in Fig. 257.

THE GUNWALE CLAMP. The hole through the bar, next to the brackets, is for a $\frac{3}{16}$-inch bolt for the gunwale clamp. Make the lower lug of the clamp of half a hinge (Fig. 261).

ASSEMBLING

Buy $\frac{3}{16}$-inch stove bolts 2 inches long, iron washers and wing nuts, for fastening the bars together, and $\frac{3}{16}$-inch bolts $1\frac{1}{2}$ inches long, washers and wing nuts for attaching the leeboards. The length of the gunwale clamp bolts will be determined by the depth of the gunwales. Use wing nuts for them also.

ATTACHING AND ADJUSTING THE LEEBOARDS

To attach the leeboards, adjust the thwart bars to the correct length to bring the gunwale clamp lugs under the lower edge of the gunwales. Tighten the wing nuts. Then bolt the leeboards to the thwart brackets.

FINISHING

To finish the leeboards and thwart, sandpaper all surfaces smooth. Then apply a coat of shellac, rub lightly with fine sandpaper, and apply two coats of spar varnish. If you want to, stain the wood to match the canoe finish, before shellacking, or use a varnish stain.

Chapter XVII

CAMP CRAFT

Wood Craft and Gadgets for Idle Moments—A Thatched Lean-to—A Head Tent—A Camp Chair—A Hat Rack—Tent Clothes Hangers—A Canoe Seat Back—A Camp Table and Seats—A Food Safe—A Minnow Box—A Minnow Seine—A Dip Net

IDLE moments at camp may be profitably spent in wood craft, building gadgets that make for roughing it smoothly. You will probably find the materials for such work at hand, and no doubt you will be equipped with a saw, hammer and nails with which to shape and assemble them.

A THATCHED LEAN-TO

The woods shelter in Fig. 262, set up on your camp site or within hiking distance of home, may be substituted for a tent. A fire with reflecting back logs built in front of it makes it possible to sleep warm even when nights are cold. Provide a front flap if you want to. It is advisable to select high ground for the lean-to and to build the framework so the closed end will be in the direction of prevailing storms.

MATERIAL. Unless the woods have been cleared of underbrush and fallen timber, you can probably pick up enough straight, sound branches for poles, and

brush for covering them. If it is necessary to cut a few saplings or branches, be sure to get permission from the owner. Lacking enough long poles, splice short pieces end to end and use a broken oar, spar, or anything that will serve.

THE FRAMEWORK is shown in Fig. 263. Use a tree for a support. Spike or lash a 5-foot pole to the

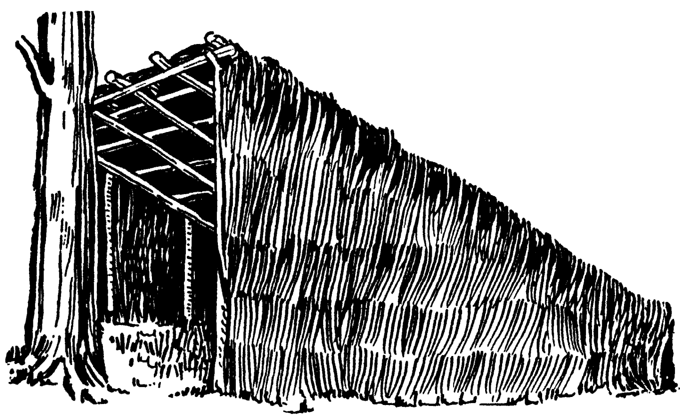
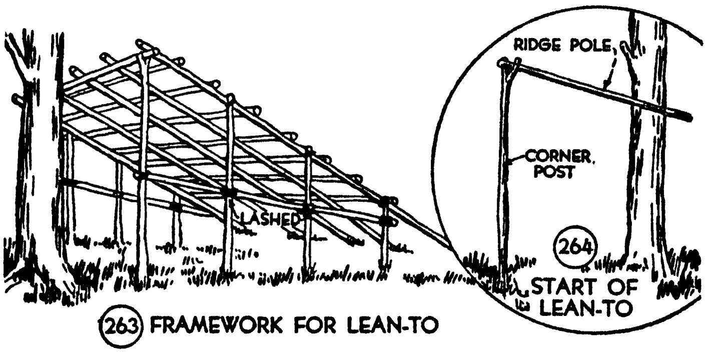


FIG. 262. A THATCHED LEAN-TO

trunk about 5 feet above the ground, for the ridge pole (Fig. 264). Let one end project slightly. Rest the other end upon an upright with crotched end. Select five or six poles 8 or 9 feet long for roof poles, and run them from the ridge pole to the ground. Space them at equal distances apart. Then cut eight or nine cross poles and lash them to the roof poles with equal spacing. Complete the framework by setting three uprights along the ends and fasten their tops to the end rafters.

THATCHING the framework is a simple job. Cover the roof poles with boughs or brush cut in 2-foot lengths, beginning at the ground and working up, as you would lay shingles. Place the boughs with tips down, close together, and let the tips of the second row overlap the butts of the first row, to make a tight, water-shedding surface . In this way, lay row upon row until the ridge is reached. Then thatch the



FIGS. 263-264. DETAILS OF LEAN-TO FRAMEWORK

sides. Cross poles may be used for additional supports. Hang the upper portion of the side thatching from the roof poles.

A HEAD TENT

The head covering shown in Fig. 265 will be welcome when mosquitoes are abroad. Two yards of mosquito netting are sufficient to make it. Sew several 24-inch lengths of tape or rope along the center of the netting and suspend the tent by these to a low hanging branch as shown in the sketch. Tie

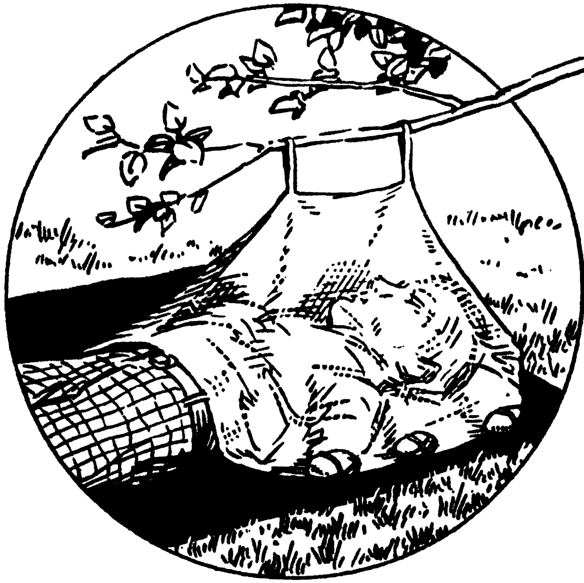


FIG. 265. HEAD TENT

FIG. 266. A CAMP CHAIR

stones to the edges of the netting to hold them close to the ground.

A CAMP CHAIR

Figure 266 shows a comfortable chair that you can rig up quickly. Fasten the upper ends of a pair of 7-foot poles to opposite sides of a large tree trunk, about 4 feet above the ground. Fasten two cross poles to them, one at the trunk, the other 18 inches from the ground. Then get a piece of canvas that will reach from one cross pole to the other, with enough slack for the seat and back, and for fastening around the poles, and tack it to the poles, or lace it with wrapping twine.

A HAT RACK

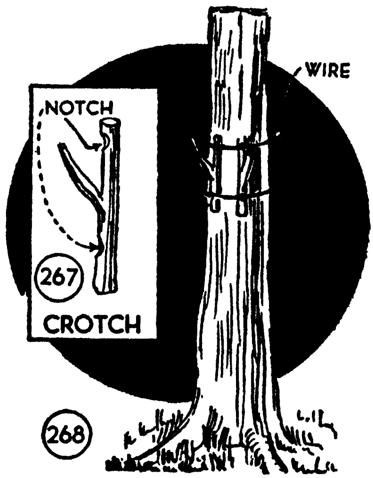
The stub end of a tree branch is a natural hat rack. If you don't find one at hand, cut a crotch like that in Fig. 267 and bind it to a tree with wire or rope, as shown in Fig. 268.

TENT CLOTHES HANGERS

Figure 269 shows a row of clothes hangers of great convenience in a tent. Buy a nickel's worth of spring clothespins, some heavy wire and two large screw eyes. Screw the screw eyes into the tent poles several inches below the ridge, string the clothespins onto the wire, and fasten the wire ends to the eyes.

A CANOE SEAT BACK

The seat back in Fig. 270 is a light-weight rig that is easy to make. Cut the side posts and cross rails



FIGS. 267-268. A HAT RACK

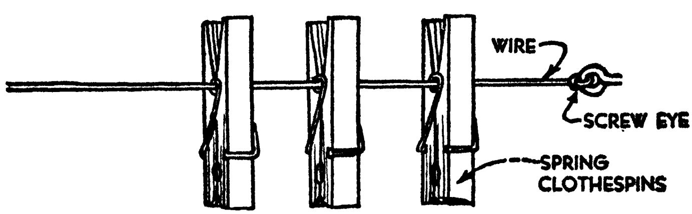
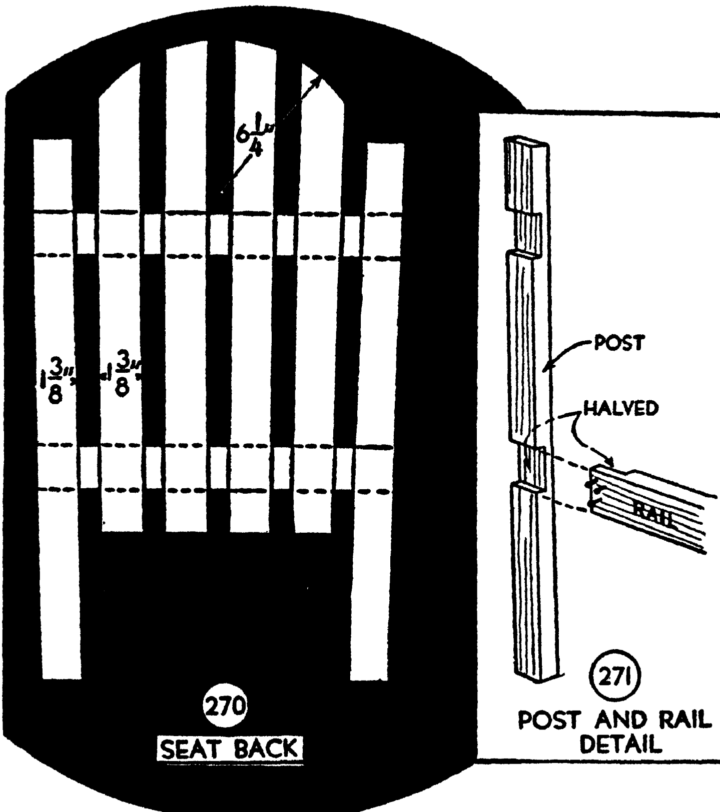


FIG. 269. TENT CLOTHES HANGERS

out of 1-by-2 stock, the vertical slats out of $\frac{5}{16}$ by $1\frac{3}{8}$ lattice strips or laths. Halve the posts and rails as shown in Fig. 271, to make flush joints, and screw them together.

Cut the slats 20 inches long and screw them to the rails with equal spacing. Describe the top arc with the given radius, using a string, pencil and nail for a compass, and trim off the slat ends to this curve.



FIGS. 270-271. A SEAT BACK FOR YOUR CANOE

Finish the seat back with a coat of shellac and two coats of spar varnish. Rub lightly with sandpaper between coats.

A CAMP TABLE AND SEATS

Now for a good place to sit down and eat. The dugout table and benches in Fig. 272 answer admirably, and they are easy to shape. Mark off a space 20 inches wide and 36 inches long upon the ground for the table. Dig a trench each side of it 10 inches wide and 12 inches deep for leg room, and

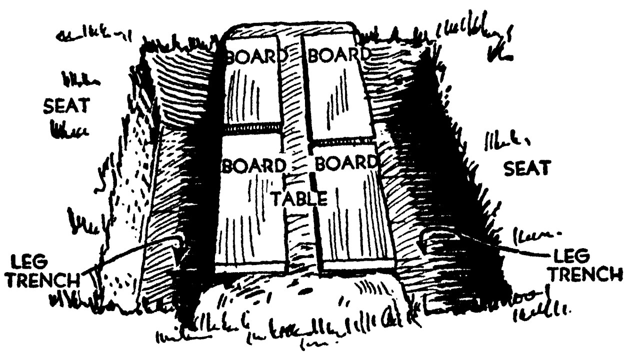


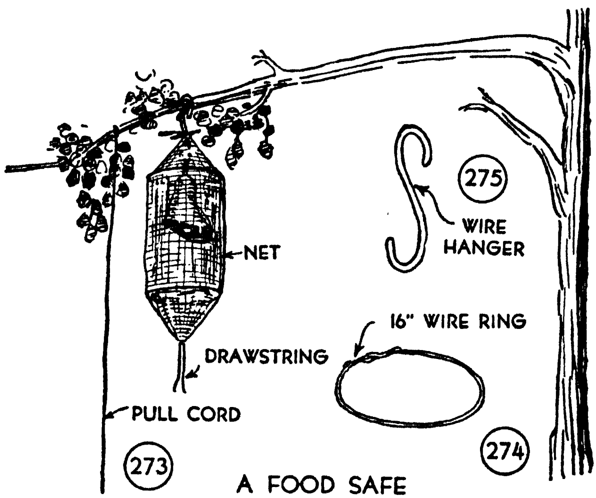
FIG. 272. A CAMP TABLE AND SEATS

pile enough of the excavated earth upon the table to increase its height 5 or 6 inches. This will make the table of the right height for the benches, which will be of ground level. Boards will improve the table top, but they are not necessary if you can pack the earth to form a hard surface.

A FOOD SAFE

Figure 273 shows a safe for fish, meat and other foods. It consists of two rings 16 inches in diameter

bent out of wire (Fig. 274), a yard of netting and a wire hanger (Fig. 275). Fold the netting to form a bag of the diameter of the hoops, slip the hoops into it and sew the netting to them. Sew casings in the bag ends and run fishing line or light rope through them for drawstrings. Bend a wire hanger of the



FIGS. 273-275. DETAILS OF A FOOD SAFE

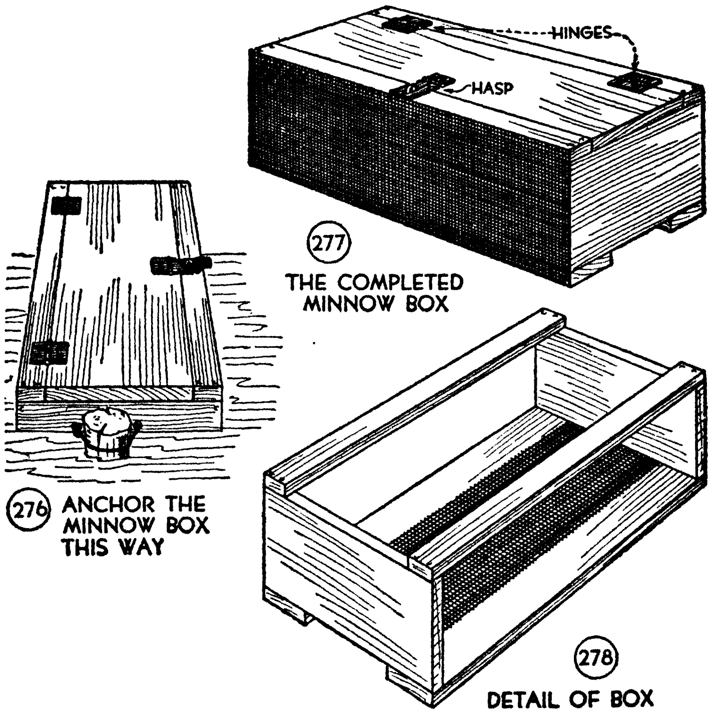
shape shown in Fig. 275 and fasten it to the upper end of the safe.

Hang the food safe from a branch in a shady place and tie a rope to the branch with which to pull it down within reach.

A MINNOW BOX

Anchor your live-bait box offshore as suggested in Fig. 276 or fasten it beneath a pier. The latter

arrangement is a good one if the pier is low enough so that the box can be reached easily through a trap door in the pier flooring. Of course, the water level



FIGS. 276-277. A MINNOW BOX
FIG. 278. DETAIL OF BOX

must be several inches below the box top so that there will be a flow of air over it. That is a very necessary provision.

THE BOX should have a depth of about 12 inches, width of 14 inches and length of 20 inches. Since

wooden boxes are not plentiful as they used to be, you may have difficulty in finding one of this size. If so, build a box of two smaller ones, or of any boards at hand.

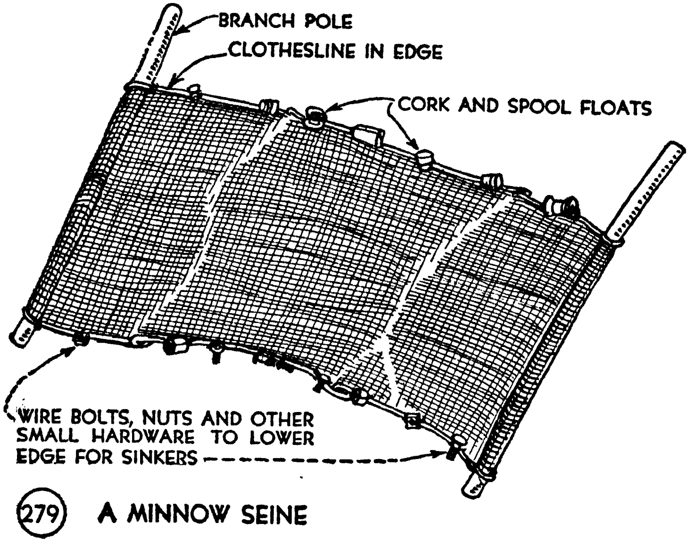
The Framework. Figure 277 shows the completed box and Fig. 278 the framework. If you find a box of the right size, remove both sides and nail two strips across the top, one at each side. Also, remove one of the bottom boards, or part of one board, so that there will be an opening in the center of the box bottom.

Cover the openings with galvanized screen wire. Then cut a board to fit the box top and hinge it to one of the top strips for a door. Attach a hinge hasp to the door and a staple to the edge strip, so that you may padlock the box.

A MINNOW SEINE

Prepare a seine like that in Fig. 279 for capturing minnows. Get several yards of mosquito netting or marquisette, 40 inches wide or wider, and two straight branches, broken oar ends or curtain poles, about 12 inches longer than the netting is wide. Bind both edges of the netting with clothesline. Tie the ends of the rope to the poles and tack the end edges of the netting to the poles.

To complete the seine, weight the lower edge with bolts, nuts and other small pieces of metal. Fasten these to the clothesline with wire. Tie pieces of cork, balsa wood, and spools to the upper edge of the seine to give it buoyancy.



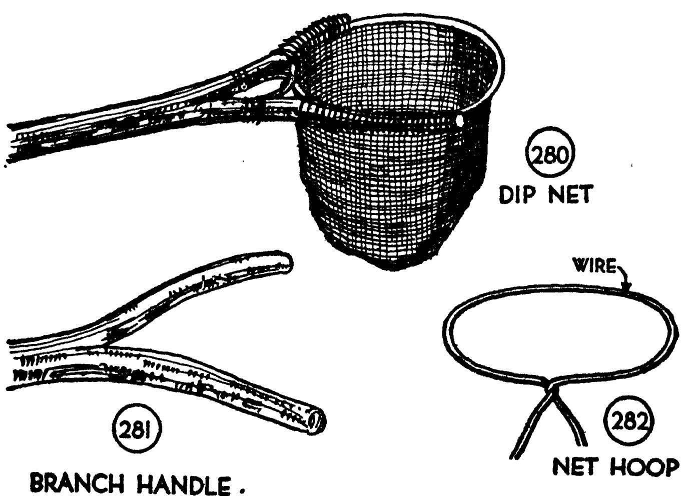


FIG. 279. A MINNOW SEINE
FIGS. 280-282. DETAILS OF DIP NET

A DIP NET

You will need a dip net like that in Fig. 280 to transfer minnows from the seine to the minnow box, and from the box to your bait pail. Make its handle of a forked branch (Fig. 281), and its net hoop of heavy wire (Fig. 282). Ask Mother to sew up a piece of netting to form a net 8 or 10 inches deep, with a casing in its top through which to run the hoop. Lash the hoop to the branch handle with fishing line, heavy cord or wire.

Chapter XVIII

OUTDOOR FIREPLACES

The Fun of Outdoor Cooking—Fireplaces for the Back Yard, Camp and Beach—A Log Fireplace—A Crane Fireplace—A Stone Fireplace with Grill—A Beach Oven—A Bank Oven—Learn the Secrets of Baking

It is fun to cook upon an outdoor fireplace, as you know if you have tried it. Whether or not your cooking measures up to Mother's makes little difference because you will not be finicky about your own cooking when you have worked up a good appetite. If others complain, let them take a turn as cook.

You can build the fireplaces shown in this chapter in the back yard, at camp or on the beach.

A LOG FIREPLACE

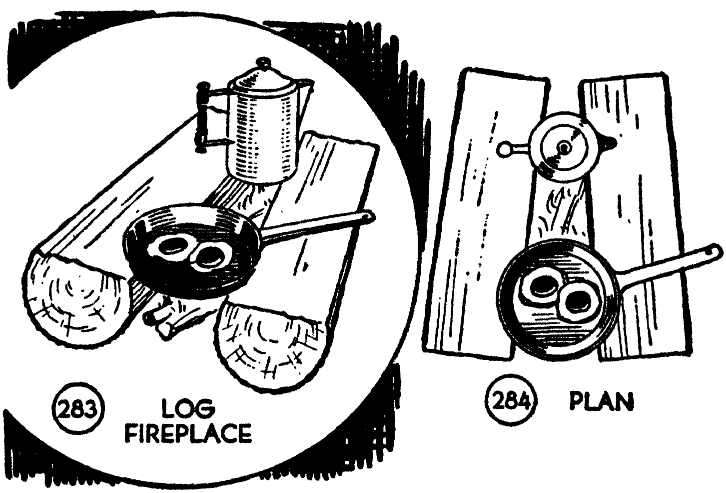
In Fig. 283 we have the twin-log fireplace with the tops of the logs flattened with an ax to provide surfaces for cooking utensils. By placing the logs so that two ends are close together, as shown in Fig. 284, it is possible to accommodate small as well as large-bottomed utensils.

A CRANE FIREPLACE

The fireplace in Fig. 285 is built like the twin-log fireplace in Fig. 283, with the addition of the pot

crane. Drive poles into the ground at the fire pit ends. If you cannot get branches with crotches, make forked ends as shown in Fig. 286.

MAKE POTHOOKS of wire (Fig. 287). You will need several lengths and a number of each length.



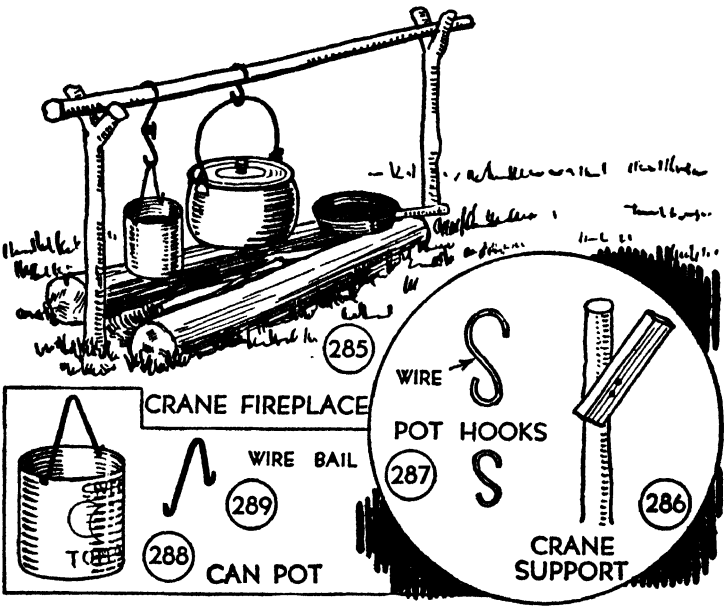
FIGS. 283-284. A LOG FIREPLACE

POTS. Figure 288 shows how to make a pot of a tomato can. Shape a bail like that in Fig. 289 of wire.

A STONE FIREPLACE WITH GRILL

Figure 290 shows a fireplace built of stones. Figure 291 is a plan. Field stones, flat pieces of quarried stone, or concrete blocks may be used. Since the draft of this type of fireplace, or the twin-log fire-

place in Fig. 283, must be from front to back, place the stones or logs in relation to the direction of the prevailing wind.



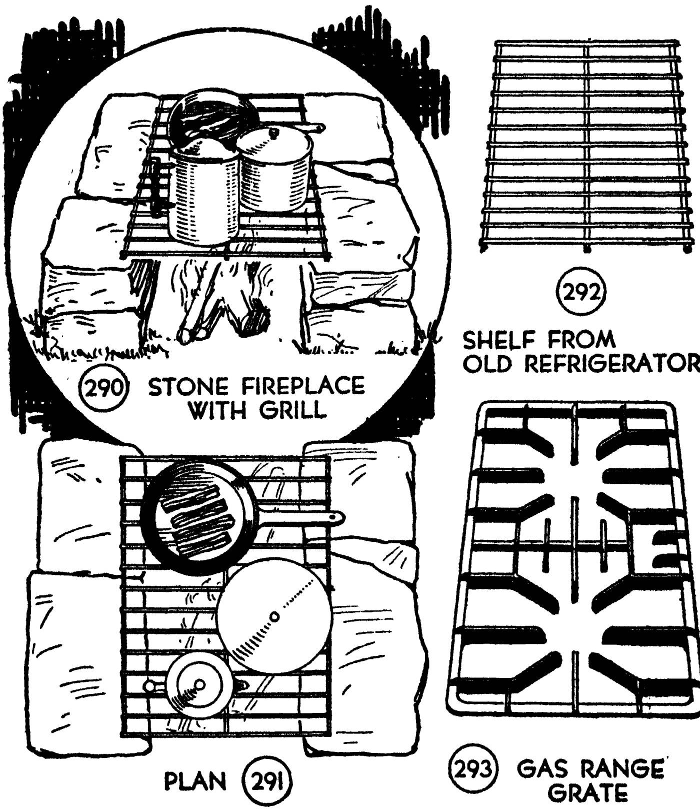
FIGS. 285-289. A CRANE FIREPLACE WITH GRILL

Perhaps you can find a welded refrigerator shelf (Fig. 292), a gas range grate (Fig. 293), or several pieces of iron bar or pipe, for the grill.

A BEACH OVEN

An oven is necessary for the success of beach parties. You will use it for roasts of different kinds. Its heat will be welcome on chilly evenings.

Then, too, it will be a handy incinerator for beach litter.

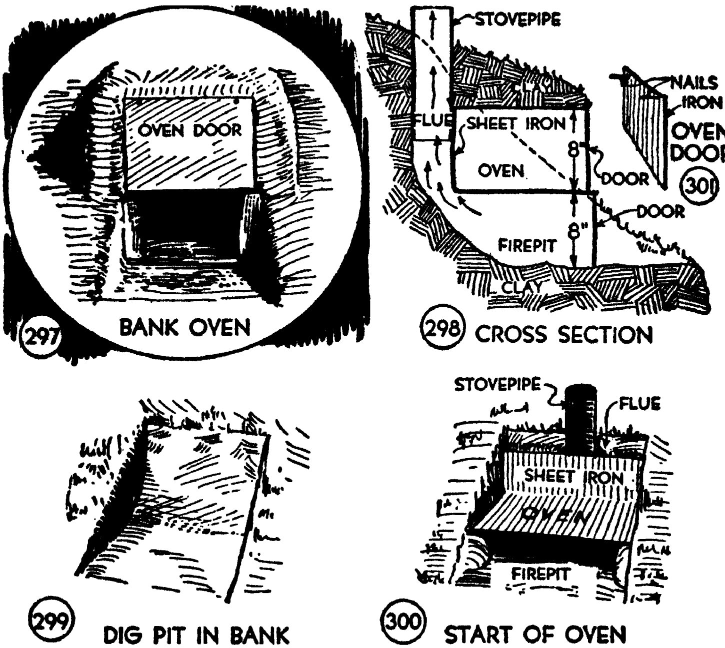


FIGS. 290-293. A STONE FIREPLACE WITH GRILL

You can build a simple oven like that in photograph Fig. 294 in an afternoon. Its size is optional. The oven illustrated is 18 inches wide and deep and 16 inches high. It has sides of field stone, a hearth

sloping back to form a throat for the chimney flue, as shown in Fig. 298. Level off the bottom.

THE OVEN. Get a piece of sheet iron for the oven bottom. A section of stovepipe separated at the



FIGS. 297-301. DETAILS OF A BANK OVEN BUILT SIMILAR TO THAT IN PHOTOGRAPH FIG. 295

seam and flattened will do. Bend up 8 inches of one side of this piece to form the oven back, and set the piece in place as shown in Fig. 300, about 8 inches above the fire pit, with a space of 3 inches back of it to allow for the chimney flue. Build up the oven ends with the clay or earth removed from the fire pit,

wetting it to make it pack. Carry the oven ends up to the height of the iron back, and set in another piece of sheet iron to form the oven top.

COMPLETE THE CHIMNEY FLUE with a section of stovepipe, or several large tin cans with bottoms removed. Then finish off the oven top with an insulation of clay or earth.

DOORS. Make the fire pit and oven doors of pieces of sheet iron with nails driven through the upper edges (Fig. 301). The nails will form hangers for holding the doors in position.

LEARN THE SECRETS OF BAKING

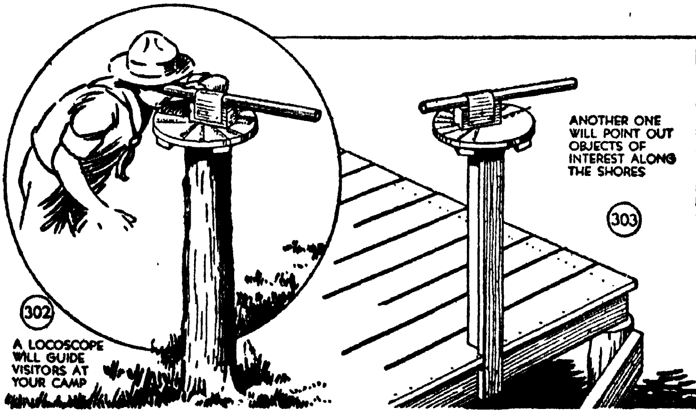
Learn the secrets of baking from Mother. Then with the right fire you will find it no trick to bake biscuits, corn bread and other camp foods.

Chapter XIX

A CAMP LOCOSCOPE

A Guide for Camp Visitors—A simple Gadget to Make—Where to Place It—A Support—The Locoscope Table—The Sighting Tube—Directional Data

CAMP visitors are sometimes left to their own resources, when the boys are engaged in activities or



FIGS. 302-303. SET UP THE LOCOSCOPE IN ONE OF THESE WAYS

away on hikes, and it is a wise plan to provide means by which they can find their way about without interrupting routine work at headquarters. The problem may easily be disposed of by installing a camp locoscope similar to that shown in Fig. 302. It is a simple gadget to make and an excellent wood craft project.

WHERE TO PLACE IT

The locoscope should be set up in a clearing near the camp entrance. If the camp covers much acreage, it would be well to install several. A good position for a second locoscope would be on a signal tower, or on a hill commanding a full view of the camp. A third might be set up on a pier to locate points of interest along the shores (Fig. 303).

A SUPPORT

A tree stump will make a solid support for the locoscope, but stumps are not always so accommodating as to be in the right place. Lacking a stump, set any kind of post far enough into the ground to secure firm anchorage. A footing of concrete is better if you have materials to cast one. A locoscope on a pier may be supported upon a base built onto the pier structure, as indicated in Fig. 303.

THE LOCOSCOPE TABLE

The locoscope table should be 12 inches or more in diameter (Fig. 304). You may have to batten two boards together to get the right size, as shown in Fig. 305. Leave the table square if you want to, but it is no trick to cut it round after you have attached the battens, and the disk shape makes a trimmer job. Be careful to locate the batten nails so that they will be out of the way of your saw when you cut the disk.

THE SIGHTING TUBE

Get a piece of iron pipe ¾ inch or 1 inch in diameter and about 18 inches long, for the sighting tube

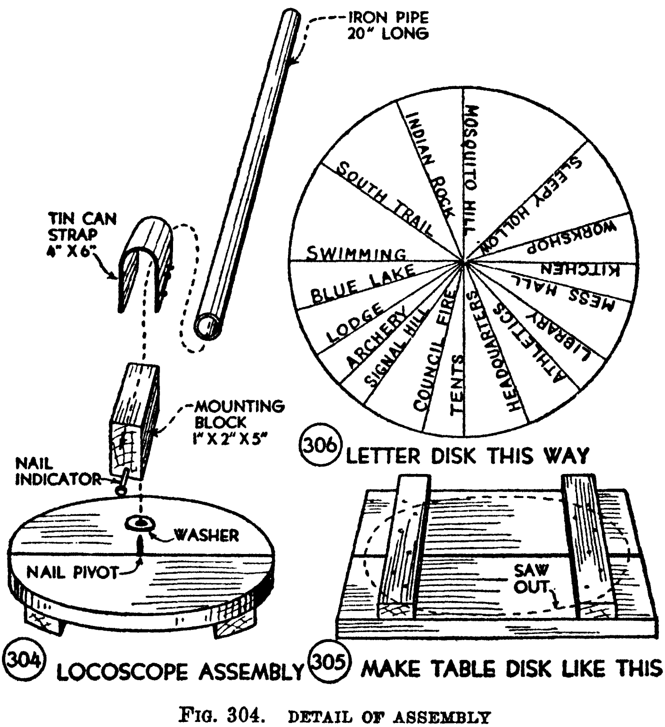


FIG. 304. DETAIL OF ASSEMBLY
FIGS. 305-306. DETAILS OF TABLE DISK

(Fig. 304). Cut a wooden block 1 inch thick, 2 inches wide and 5 inches long on which to mount the pipe, and cut a piece of tin 4 inches wide and 6 inches long to make a strap for fastening the pipe to the block.

Place the pipe on the block with one end projecting 5 inches, and bind it to the block with the tin strap. Mount the block upon the center of the table with a long screw or nail driven through the under side of the table into its center. Place an iron washer between the table and the block. Drive a nail part way into the rear end of the mounting block for an indicator (Fig. 304).

DIRECTIONAL DATA

With the sighting tube mounted, fasten the table upon its support. Then you will be ready for the directional data. Points within clear view may be sighted through the tube and lettered upon the disk directly below the indicator of the mounting block. But points obscured from view will have to be located by the aid of two or three assistants. Have these lads work out the lines over buildings and hills by the means of sighting rods held in line with the points and the sighting tube. Draw radial lines from the disk center to the rim (Fig. 306) on which to letter the captions in pencil or drawing ink, preferably the latter. Give the disk a coat of shellac and another of spar varnish, to protect the lettering.

Chapter XX

UNDER-WATER GOGGLES

Under-water Explorations—The Materials Cost Nothing—The Lens Band—The Lens Frames—The Head Loop

TAKE along a pair of home made goggles like those worn by the boy in Fig. 307 next time you go to the lake. They will enable you to open your eyes under water and experience the thrill of submarine exploration.

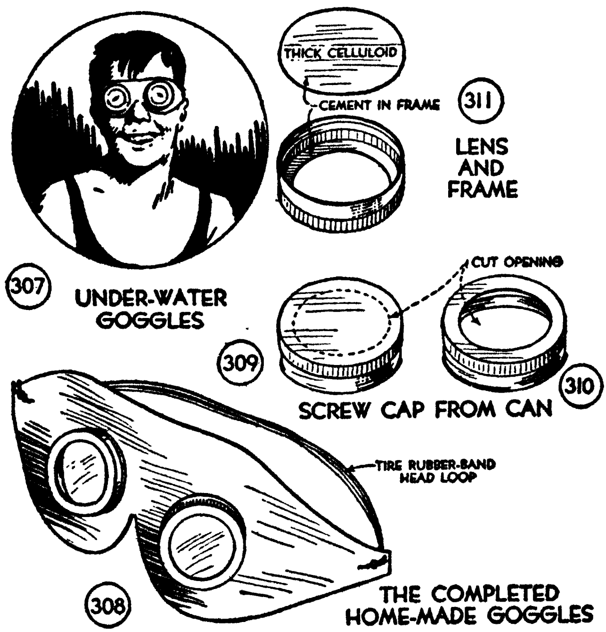
THE MATERIALS COST NOTHING

Figure 308 shows a detail of the completed goggles. The lens band is a piece of an automobile tire tube, the lenses are of heavy celluloid, the lens frames are made from screw caps of tin cans, or olive, pickle, or salad-dressing bottles, and the head band is a strip of tire tube. Therefore the goggles will cost you nothing to make, except for cement for cementing the lens band to the lens frames.

THE LENS BAND

You need not follow the pattern in Fig. 312 in laying out the lens band, but it has been made of the right shape and size to fit your face, and you will find it easier to enlarge it by means of the squares than

to work out a pattern of your own. Each square of the pattern represents ½ inch of a full-size pattern. Rule horizontal and vertical lines with a spacing of ½ inch, to prepare similar squares, then draw the



FIGS. 307-311. THE UNDER-WATER GOGGLES AND THEIR ASSEMBLY

curved lines across them just as they are shown upon the printed pattern.

The lens frame openings are to be cut ½ inch smaller than the frame diameter, so that the elasticity of the rubber will hold them snugly in place. If you use screw caps of 1⅝ inch diameter, as were used for the goggles illustrated, describe the openings 1⅛ inches in diameter.

When you have laid out the pattern upon paper, cut it out and mark around it upon the piece of tire tube. Cut the rubber with scissors or a sharp knife.

THE LENS FRAMES

Prepare the lens frames as shown in Figs. 309 to 311. Describe a circle 1⅛ inches in diameter upon the bottle cap for the opening (Fig. 309) and cut along the line with a can opener or small cold chisel

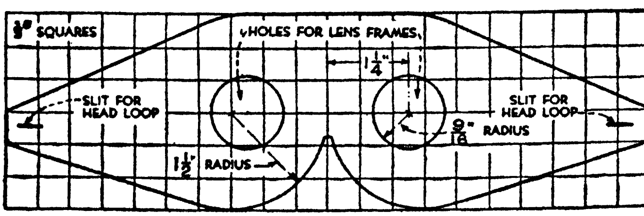


FIG. 312. CUT THE LENS BAND FROM AN AUTO TIRE TUBE

(Fig. 310). Then cut two pieces of heavy celluloid to fit inside the caps for lenses (Fig. 311) and cement them in place with a cement that will hold fast and make a watertight job.

THE HEAD LOOP

Complete the goggles by attaching a strip of tire rubber to the end of the lens band to make a head loop of the right length to hold the goggles close to your face.

Chapter XXI

A LAWN SHOWER

New Pipe and Fittings Not Necessary—Use a Garden Hose for All or Part—The Shower Base—The Pipe Assembly—The Shower Head—A Shower Stall

IT IS not necessary to have new pipe and fittings for a lawn shower. Indeed, you need not use pipe at all. You can nail a wooden cross arm to a pole upright, fasten the garden hose to the pole and extend it to the end of the arm. Use your ingenuity in rigging this kind of job, or in simplifying the outfit illustrated in Fig. 313.

THE SHOWER BASE

Make the base for the shower of two pieces of 1-by-2 36 inches long, fastened together with a halved joint, as shown in Fig. 314. Notice that this joint is made by cutting away enough from each piece for the pair to interlock in a snug joint.

THE PIPE ASSEMBLY

All parts of the pipe assembly are of ½-inch dimension. That is, inside measurement. A ½-inch pipe is about ¾ inch in diameter, outside. The fittings required are shown in Fig. 315. A floor flange

is screwed to the base. An 8-inch nipple is screwed into the floor flange, and a tee fitting is screwed to the nipple. The tee is provided for the hose connection (Fig. 313). Next, a piece of pipe 30 inches long

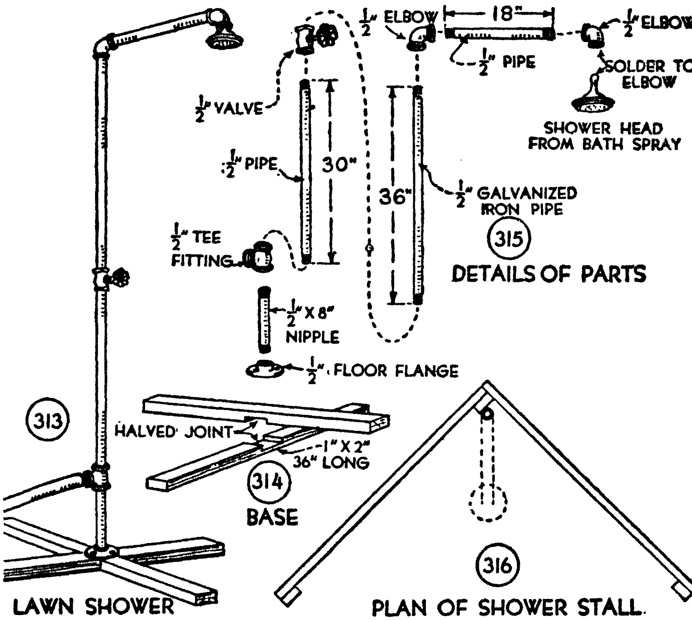


FIG. 313. THE COMPLETED SHOWER
FIGS. 314-315. DETAILS OF PARTS
FIG. 316. PLAN OF SHOWER STALL

is screwed into the tee. Then a valve shut-off is added and a piece of pipe 36 inches long is connected to the valve. An elbow makes the turn at the top, the arm is a piece of pipe 18 inches long, and a second elbow at the end receives the shower head.

Have the pipe cut and threaded by a plumber or

hardware dealer. Coat the threaded ends with thick paint, and use a pipe wrench to make up the parts,

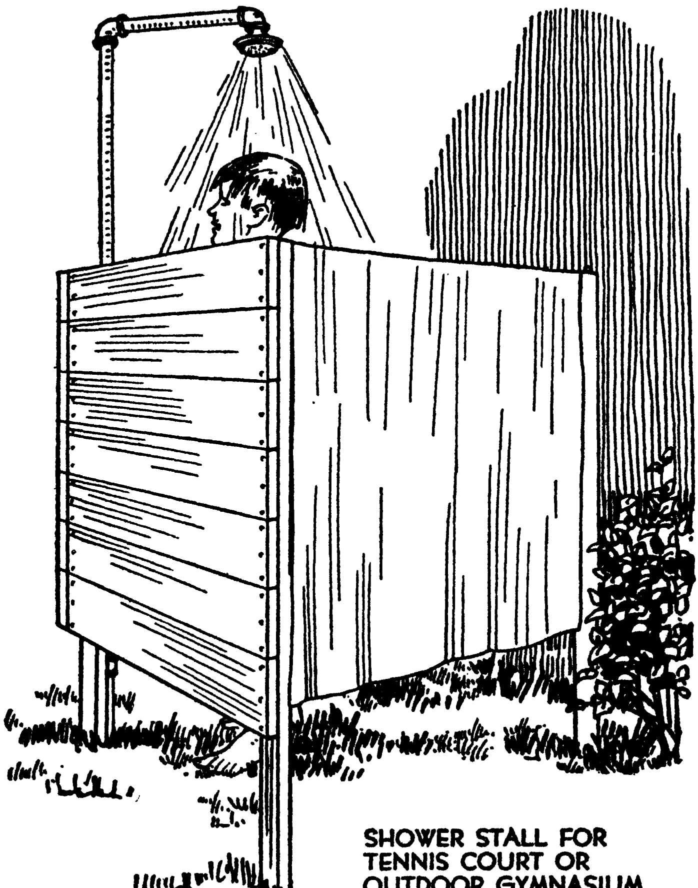


FIG. 317. YOU CAN BUILD THE SHOWER STALL OF OLD BOARDS

turning each as far as it will go, to insure tight joints.

THE SHOWER HEAD

The head from a bath spray makes a good shower head. If you do not find one at home, buy one at the dime store. Solder it to the elbow fitting. To do this, unscrew the elbow, put it in your bench vise, stuff it with paper, temporarily, center the shank of the shower head in one end, and run in solder around it. Of course, you must have the metal surfaces clean and you must coat them with a soldering flux so that the solder will adhere.

A SHOWER STALL

If you want a shower stall for your tennis court or outdoor gymnasium, build it as shown in Fig. 317. The stall is triangular-shaped (Fig. 316) with two sides of boards, the third inclosed with a curtain of cotton duck, burlap or other heavy material. You can use old boards for the sides. Batten them together with 1-by-2s. Make the sides about 40 inches square, and let the 1-by-2 battens project about 14 inches for legs. Provide nails to hook the curtain ends on to.

Fasten the shower fixture in the corner of the stall as indicated in Fig. 316.

PART III

AUTUMN OUTDOOR HANDICRAFT

Chapter XXII

A TREE HUT

Riding a Storm in a Tree Hut, Imagining it an Airliner—Air-minded Boys Want Air Homes—The Tree Determines the Form of Hut—A Hut in a Willow Tree—A Jacob's Ladder—The Willow Tree Drawbridge—A Two-Tree Hut—Bunks—A Radio—Heating

If you want to experience the sensation of riding a storm in an airliner, select a night when the weather bureau has issued storm warnings. Don a helmet, goggles and a leather jerkin, climb into the cabin of a tree hut and seat yourself in a swivel chair. To help the imagination, take along a flash-light and a book of airplane adventures. You won't need the latter after the storm breaks, but by then it will have served its purpose. Boy! Feel those air bumps! You zoom to get above the storm! You roll! You side slip! A flash of lightning! Crash! The right wing has crumpled! You're in a tail-spin! You grab your 'chute! You throw open the cabin window! Wow! The wind takes away your breath! Rain sloshes your face! A flash of lightning! All about you is space! Another flash! Crash! Tree branches are revealed below! You and the wreckage are safely nestled in a tree top. A good test of nerve, this, for you fellows who expect some day to pilot a plane under soupy weather conditions and worse.

There has been increased activity in tree hut building, in recent years, and undoubtedly aviation has had its influence. What could be more natural for an airminded boy than to want a home in the air? What say you about a tree hut or hangar for your aviation club? Surely there is a tree with spreading limbs, or a pair of trees, in which you might build a hut.

THE TREE DETERMINES THE FORM OF HUT

Where is your tree? Each tree has its particular problem. A tree with many limbs affords excellent support for a hut. A straight tree with few large limbs may have a hut built around it, supported upon brackets. A group of two, three or four trees may have a hut hung among them.

A HUT IN A WILLOW TREE

Photograph Fig. 318 shows a hut built by Boy Scouts in a willow tree. New lumber was not available, and the boys had to do the best they could with boards from a tumble-down barn. But old boards met the specifications for a substantial foundation, a tight roof, a door and window, bunks, a stove and room enough to turn around in, which are all the essentials, and provided a front porch and drawbridge for good measure.

The Foundation. Figure 319 shows how the foundation of the willow tree hut was framed with tree branches. If 2-by-4s or 2-by-6s are available, it

would be better to use them, because of the greater ease of spiking them in place. If your tree suggests a similar construction, make certain that all branches used for floor joists are thoroughly tested for strength. Remove the bark to prevent rapid decay.

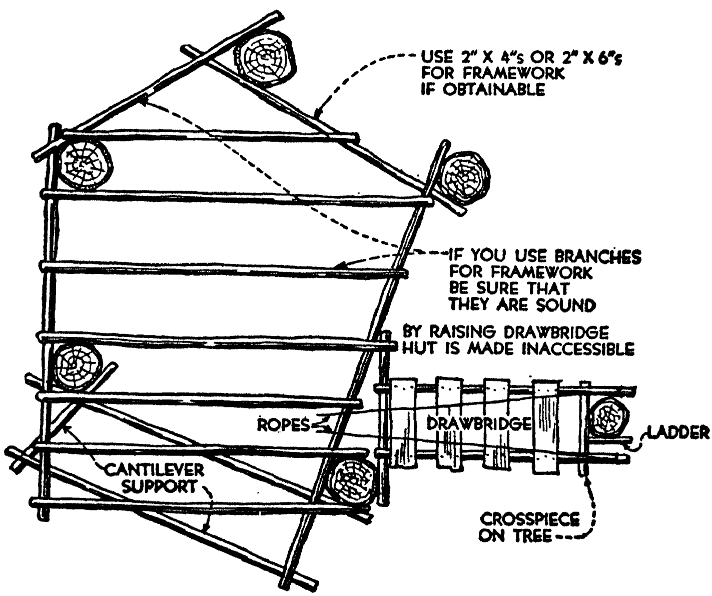


FIG. 319. FLOOR FRAMING FOR THE TREE HUT IN PHOTOGRAPH FIG. 318

In addition to the framing shown in Fig. 319, a post extends from the center tree crotch to a beam placed under the center of the floor, for reënforcement, and there are block supports and diagonal braces. Make a careful study of the framing, because each member must be secure, with no possibility of racking loose in heavy wind. Bolting may

be best in some places, anchoring with strap iron may be better in other places.

THE WALLS. With the foundation framing completed and floored over, it is quick work to set the wall studs and sheath them with boards on the outside.

THE ROOF. Make a lean-to or a gable roof, with a rise of at least 3 inches to the foot, to give adequate pitch to shed rain. Lay the roof boards close together, then cover them with heavy roofing paper.

A SCREENED WINDOW with wooden shutter is sufficient for warm weather, but a sash of the size used for basement and garage windows is not expensive, and you will need it for cold weather. Perhaps you can find an old sash. It will be no trick to reglaze a broken light or two.

A BATTENED DOOR is good enough, with pioneer latch and latch string.

A JACOB'S LADDER

Tree huts are reached by extension ladders, rope ladders, ladders made by nailing cleats to the tree trunk, and by a combination of these means. Usually the lower length is made removable, or so that it may be drawn up to make the hut inaccessible.

THE WILLOW TREE DRAWBRIDGE

To gain access to the willow tree hut in photograph Fig. 318, the boys climb into the center crotch of the tree, then up the right branch to the draw-

bridge and cross the drawbridge to the doorway. When all are in for the night, and the cat has been put out, the drawbridge is raised. This not only

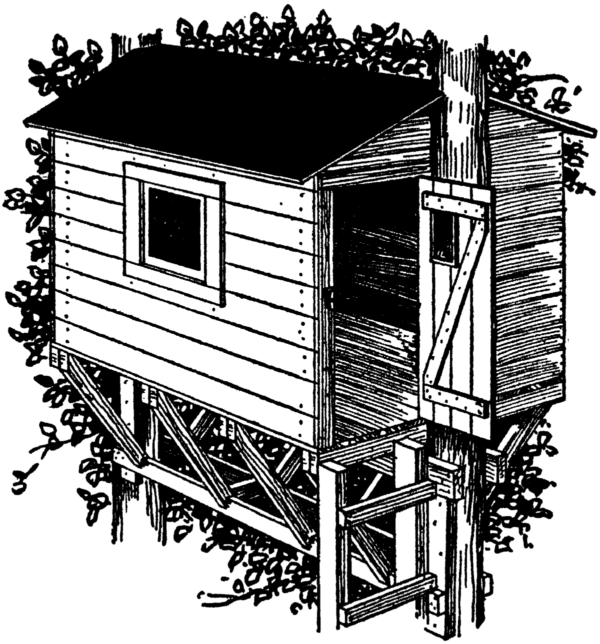


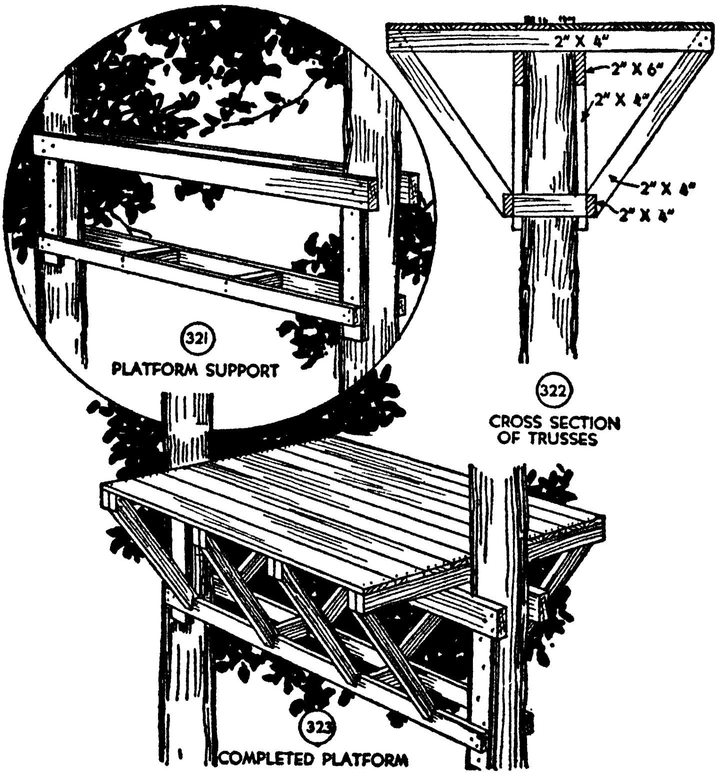
FIG. 320. A TWO-TREE HUT

keeps out uninvited guests but affords protection to airminded sleep walkers.

A TWO-TREE HUT

Figure 320 shows a simple hut between two trees. THE FOUNDATION is the first requisite, and Fig. 321 shows how to start it by spiking truss supports to the tree trunks. It may be necessary to vary the

construction because of interfering limbs, but by exercising your ingenuity you will have no difficulty in working out these problems.

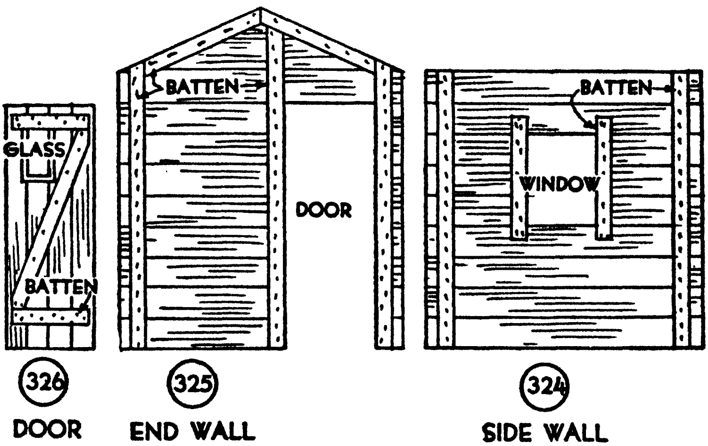


FIGS. 321-323. FRAMING FOR PLATFORM FOR A TWO-TREE HUT

With the supports firmly anchored, build the floor trusses as shown in Fig. 322, spacing them about 2 feet apart. Then floor these over to make a platform like that in Fig. 323, and all will be ready for

the superstructure. A pair of extension ladders will facilitate the erection of the platform.

THE WALLS. The easiest way to build walls is by assembling them in sections, as shown in Figs. 324 and 325. This will be ground work. Lay out the width and height of the walls upon the ground, cut boards of the right lengths, and batten them to-



FIGS. 324-326. DETAILS OF WALLS AND DOOR

gether with the uprights, which ordinarily would be 2-by-4s, but may be 1-by-4 battens if you use nails long enough to drive through and clinch. If the boards are of short lengths, set in additional battens to catch their ends. Place battens each side of the window and door openings. To get opposite walls alike, build one upon the other, using the first as a pattern for the second.

When you have completed the wall sections, hoist them into place with a rope and join their ends.

THE ROOF may be of the lean-to shed type, but a gable roof like that of the hut in Fig. 320 is a better looking job and no harder to build.

Place the roof boards lengthwise of the hut, and cover them with roll roofing or shingles.

WINDOWS. Possibly you can get a glazed sash or two for the window openings. They may be hinged or arranged to slide.

THE DOOR may be of boards battened together as shown in Fig. 326, with a piece of glass set in for extra light. Hang the door with strap hinges and provide a hook on the inside and a button on the outside, for fastening. A lock with knobs is preferable, of course, if you can get one.

A LADDER for reaching the hut entrance may be built of a pair of 2-by-4s with 1-by-2s nailed across them. This ladder need not extend to the ground, if you can substitute the tree trunk for part of the distance, spiking 1-by-2 rungs across it.

BUNKS

If you sleep in your tree hut, as you undoubtedly will, double deck your bunks. Maybe you can pick up two discarded single bed springs for them. Make straw ticks if you cannot get mattresses.

A RADIO

No modern tree hut is complete without a radio, so install an aerial and ground. A good ground will serve also as a lightning rod.

HEATING

If you install a stove, place a sheet of galvanized iron under it, and protect the wall behind it with another sheet, or with a sheet of asbestos; also, protect the wall or roof through which you run the stovepipe.

Chapter XXIII

CAMERA CRAFT

The Fun of Taking Out-of-the-ordinary Pictures—Camera Tower Photography—Operating the Camera from a Place of Concealment—A Tripper Device for Wild Life Photography—Stereoscopic Photography with Your Camera

THERE is a lot of fun in taking out-of-the-ordinary pictures and the following rigs will enable you to get a good collection. It's too late now to photograph birds on their nests, but there will be other shots that you can make of birds, and you can go after nesting pictures next Spring.

CAMERA TOWER PHOTOGRAPHY

THE CAMERA TOWER in Fig. 327 is handy for wild life photography and for getting shots from unusual points of view. Set up a stepladder and fasten a pole to one leg of the ladder, as shown in Fig. 327. Bore a couple of ¼-inch holes through the pole and ladder leg for stove bolts. Fasten your camera to the pole at the height wanted, with bands cut from an automobile tire tube. Slip the bands over the camera ends as shown.

FOCUSING THE CAMERA. With the camera set up as in Fig. 327, it will be easy to locate the picture subject in the view finder, but it may be necessary to

shift the stepladder sideways, and forward and back, before you get the correct adjustment. If the bird's nest or other object to be photographed is in shadow, rig up a mirror to reflect light on it.

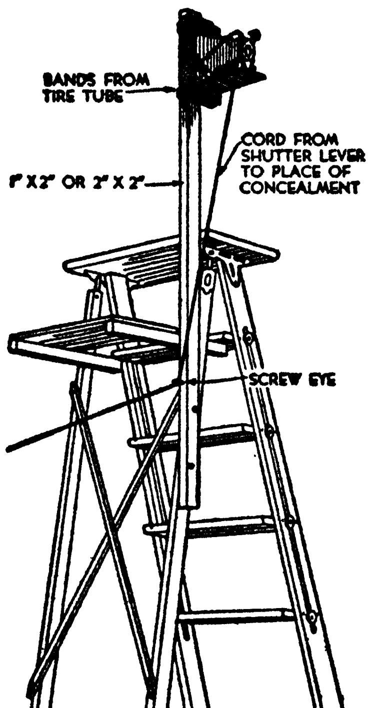


FIG. 327. CAMERA TOWER FOR PHOTOGRAPHING BIRDS IN TREES

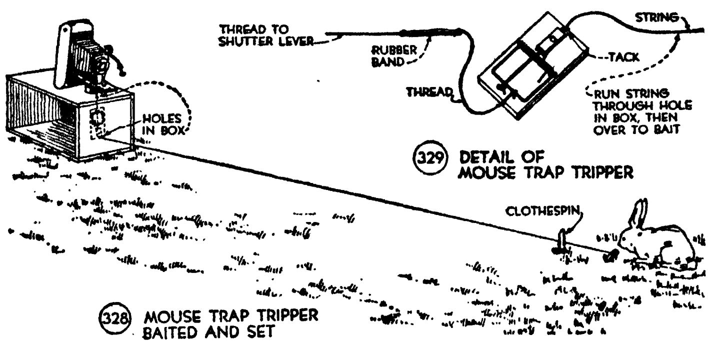
OPERATING THE CAMERA FROM A PLACE OF CONCEALMENT

For photographing wild life, operate the camera from a place of concealment a short distance from

the ladder. Field glasses will be useful to keep a bird in view. Tie a cord to the camera shutter lever, and run it down to and through a screw eye screwed into the camera support, then over to your hiding place.

A TRIPPER DEVICE FOR WILD LIFE PHOTOGRAPHY

Figure 328 shows how to photograph wild life, using a tripper device to be set off by the bird or animal, which in turn releases the camera shutter.



FIGS. 328-329. SHUTTER TRIPPER FOR WILD LIFE PHOTOGRAPHY

THE TRIPPER DEVICE is a mouse trap of the type shown in Fig. 329, with a string tied to a tack driven into the bait board and a strong linen thread tied to the wire loop. Cut the thread several inches from the trap and set in a rubber band as shown.

THE SET UP is shown in Fig. 328. Strap the camera to a box tilted so that the lens will focus upon a spot a short distance from the box. Nail the mouse trap to the inside of the box, and bore holes through the

box for the string and thread to pass through. Run the thread from the wire loop to the release bar of the shutter. Make it of the right length to spring the shutter without binding. Run the string from the bait board to the spot the lens is focused on, and tie it to a piece of fruit, meat or other likely bait.

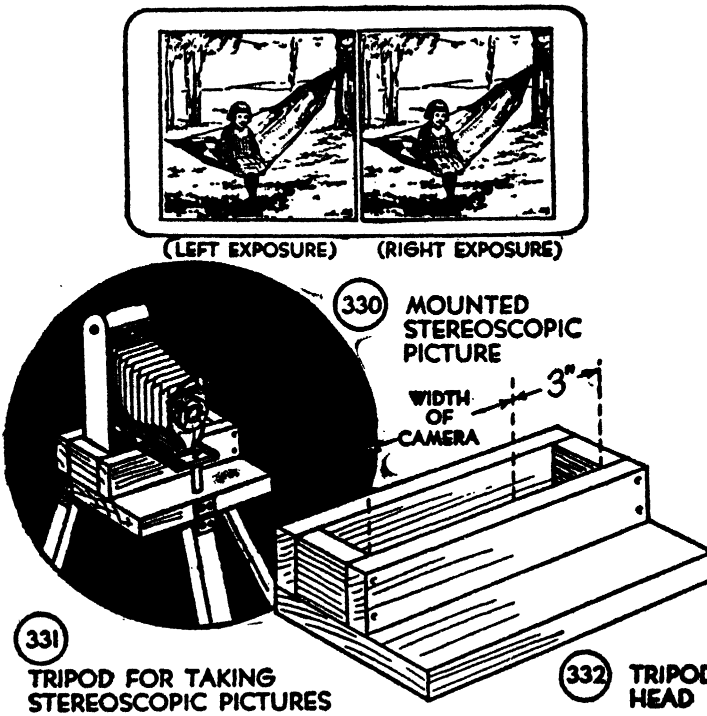
Conceal the camera as well as you can with a branch of leaves, or otherwise. Then get out of sight and await the coming of your prospective subject, who will do the rest.

STEREOSCOPIC PHOTOGRAPHY WITH YOUR CAMERA

Probably there is a stereoscope in your family, handed down from grandfather's generation, if not purchased during the recent revival of interest in stereoscopic pictures. Stereoscopic pictures are taken in pairs with two lenses in the camera lens board set at the same distance apart as your eyes. Pictures are mounted on cards like that in Fig. 330. One view shows what would be seen by the left eye, the other what would be seen by the right eye, and when the two views are seen through the stereoscope they appear as one, with the third dimension, depth, which makes every part of the picture stand out in lifelike reality.

To make stereoscopic pictures you need only set up your camera on a tripod like that in Fig. 331, and shift its position from side to side, making one exposure in each position. Of course, everything in the picture must be motionless during the two exposures.

THE TRIPOD may be an ordinary camera tripod with the special head attached to it, or it may be made by hinging three sticks to the special head, as shown in Fig. 331.



FIGS. 330-332. STEREOSCOPIC PHOTOGRAPHY WITH YOUR CAMERA

THE TRIPOD HEAD is shown in detail in Fig. 332. It consists of a head board, with strips nailed to it to form a frame for the camera to slide in. This frame must be a trifle wider than the camera's thickness and 3 inches longer than the camera's width.

Mounting the Pictures. Cut cardboard mounts 3 inches wide and 7 inches long, and mount the pictures with a $\frac{1}{16}$-inch space between them. But be sure to transpose the pictures. That is, mount the picture that you took at the left of the tripod head, on the left end of the card, and mount the picture that you took at the right of the tripod head, on the right end of the card. You will have to leave your pairs of films uncut, or mark them left and right, to know which is which when you are ready to mount them.

Chapter XXIV

A BACK STEPS KENNEL

Inclosing the Space Under the Back Steps is a Simple Job—Include the Space Under the Porch for a Larger Kennel—Framing the Kennel—The Floor and Walls—The Doorway—A Door or Gate—Painting—A Trolley for Your Dog

THE space under the back steps of most houses is large enough for a kennel, and it is a simple job to build one there, because the space is roofed and partly inclosed, making it necessary to inclose only three sides. True, steps are usually not watertight. The planks are laid with spaces between them, as in Fig. 334. But it is easy to cover these spaces with strips, on the under side. Where there is a porch with an open space beneath, that space may be inclosed also, as in photograph Fig. 338, and with a deep bedding of straw it will be quite warm enough for cold weather. My dogs have been housed in a kennel of this type for many years, but they are brought indoors when the thermometer drops to the twenties.

FRAMING THE KENNEL

Figure 333 shows a detail of the back steps kennel, and Fig. 334 shows the framework required. There must be sills on which to rest the ends of the studs, or uprights, and to support the floor boards. Old

2-by-4s can be used for these. Place them on edge, as shown. The studs may be 2-by-2s. You may rip 2-by-4s in half. Space the studs to suit the length of

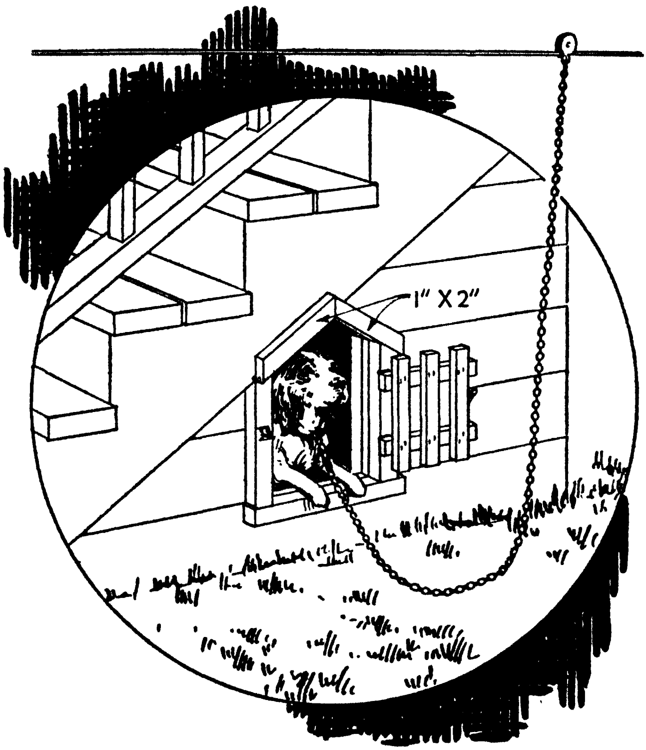


FIG. 333. DETAIL OF BACK STEPS KENNEL IN PHOTOGRAPH FIG. 338

the boards that you have for *sheathing*. Set a pair 12 inches apart for the doorway, and set in a diagonal at the top at the same pitch as the stair stringer, to frame the head of the doorway so that it will be symmetrical as in Fig. 333.

THE FLOOR AND WALLS

With the framework completed, lay the floor boards, then nail on the wall sheathing. Fit the

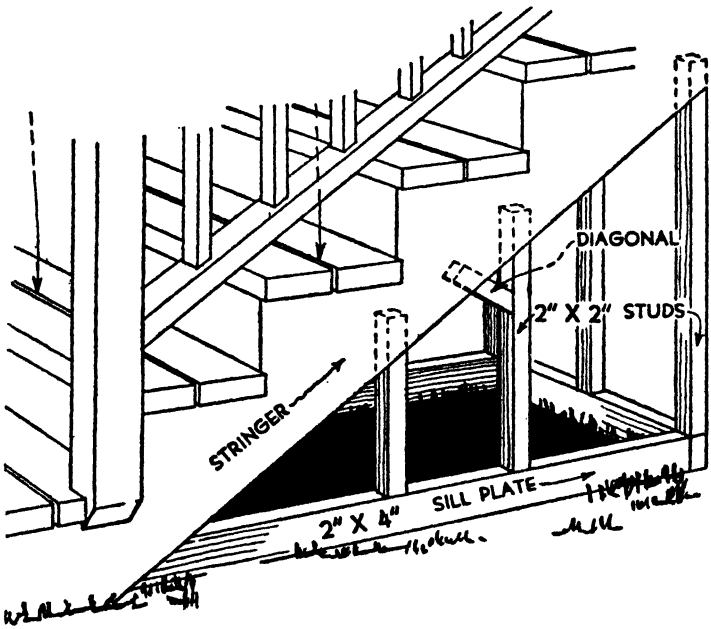


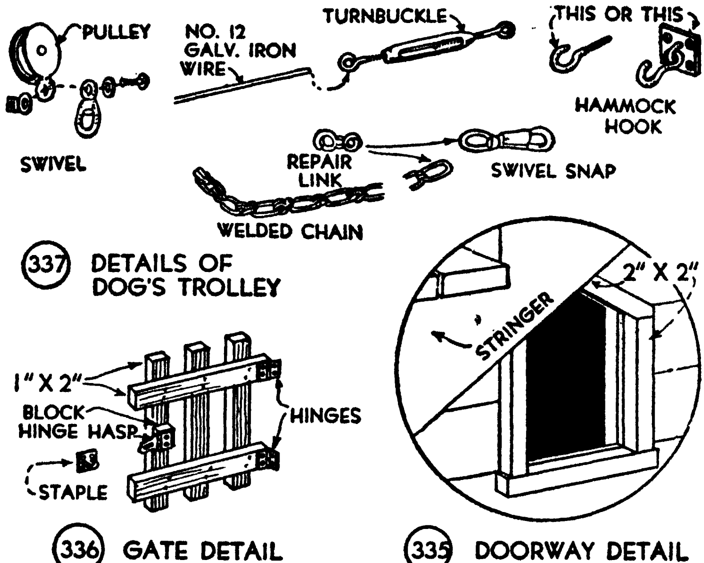
FIG. 334. DETAIL OF FRAMEWORK

boards neatly against the under edge of the step stringers, and trim them off even with the doorway.

THE DOORWAY

Trim the doorway with a piece of 2-by-2 nailed to each jamb and a diagonal piece set in to fit flush with

the stringer, as shown in Fig. 335. Then fit two pieces over the door head, for a cap (Fig. 333).



FIGS. 335-336. DETAILS OF DOORWAY AND GATE
FIG. 337. DETAILS OF DOG'S TROLLEY

A DOOR OR GATE

If you make a door, batten together two boards and hinge to one door jamb. A gate is better than a door for warm weather because it admits air for ventilation. Figure 336 shows a detail. Make it of strips of 1-by-2, crossed and screwed or nailed together. Hinge the crosspieces to one of the door jambs. Screw a hinge hasp to the gate and a staple to the door jamb in position to engage it.

PAINTING

Paint the outside walls of the kennel to match the house, with the doorway trim to match the house trim.

A TROLLEY FOR YOUR DOG

Since the ordinance of most communities prohibits the running of dogs at large, it is probably necessary for you to confine your dog to the premises. Yet provision must be made for enough exercise to keep him in good health. Next best to a fenced inclosure is a trolley to run on a wire, with one end attached to the house, the other end to a tree or a post.

THE TROLLEY WIRE must be suspended high enough to be above your head at every point. Use No. 12 galvanized wire, or heavier, or twisted wire clothes-line.

THE FITTINGS are shown in Fig. 337. Screw a galvanized hammock hook to each support, and set in a turnbuckle between the hook and wire, at each end, with which to take up the slack in the wire. Use a galvanized clothesline pulley for the trolley, a light-weight welded hammock chain for the dog's leash, and attach a strong swivel snap to the chain end. In addition to the swivel on the snap, set in a second swivel between the chain and the pulley, to keep the chain from twisting at that point. Bolt the eye of the swivel to the eye of the pulley with a short stove bolt.

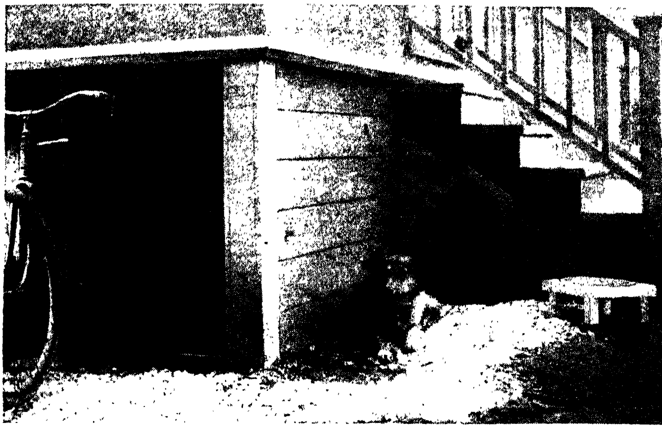


FIG. 338. WITH A DEEP BEDDING OF STRAW, THIS KENNEL IS QUITE WARM ENOUGH FOR COLD WEATHER

FIG. 339. A GOOD SINGLE COMPARTMENT HUTCH SUPPORTED HIGH ENOUGH TO BE OUT OF REACH OF DOGS

Chapter XXV

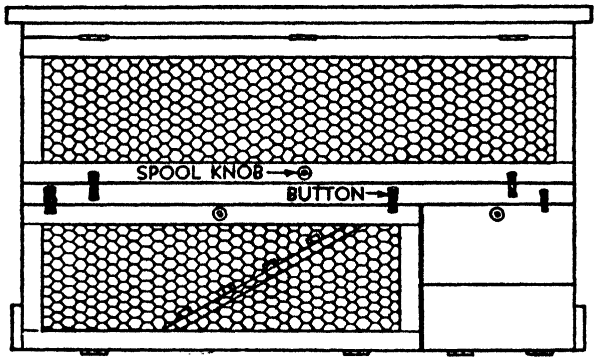
A RABBIT HUTCH

You have Rabbits or Await the Time when you Can Keep Them—A One or a Two Compartment Hutch—The Size of the Hutch—The End Frames—Inclosing Material—The Roof—A Ramp—The Nest Compartment—The Front Inclosures—Paint and Disinfectant

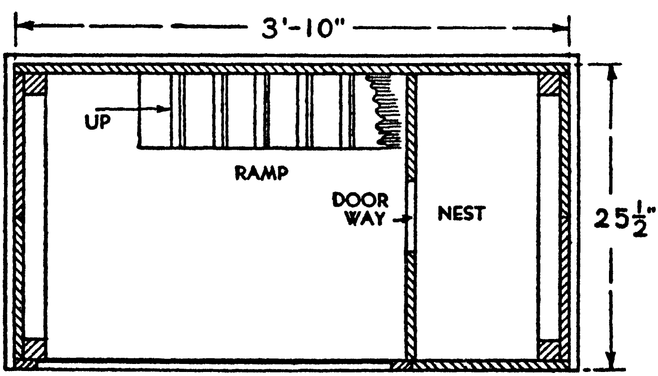
Enough of you boys have rabbits, I think, or await the time when you can keep them, to warrant my including plans in this chapter for a hutch. The diagrams show a hutch that is an elaboration of the one in photograph Fig. 339, built by Elmer Goebel.

A ONE OR A TWO COMPARTMENT HUTCH

Elmer's hutch has only one compartment, mine has two stories with a ramp and a nest compartment. Take your choice. The hutch with a single compartment is all right if you are not going in for breeding, or if you supplement it with a second hutch. A good feature of Elmer's hutch is that it is supported high enough above the ground to be out of reach of dogs. The east or south wall of a garage, poultry coop or house would be suitable for brackets for the hutch. Lacking a wall, support the hutch on trestles built like carpenter's horses but higher.



(340) FRONT ELEVATION

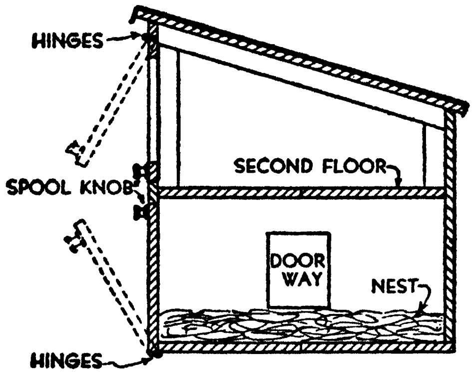


(341) PLAN

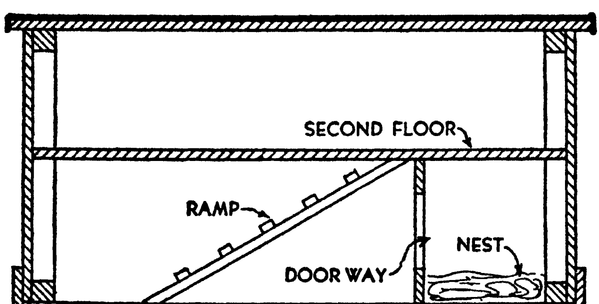
FIG. 340. FRONT ELEVATION OF HUTCH
FIG. 341. PLAN

THE SIZE OF THE HUTCH

Of course, you may make your hutch of whatever size you want. Change the given dimensions to suit



343 CROSS SECTION



342 LONGITUDINAL SECTION

FIGS. 342-343. SECTIONS THROUGH THE HUTCH

your plan. The front elevation (Fig. 340), the plan (Fig. 341), the longitudinal section (Fig. 342) and

the cross section (Fig. 343) may be used as suggestions for arrangement.

THE END FRAMES

Figure 344 shows an end frame. By making a pair of these, it is a simple matter to set them up,

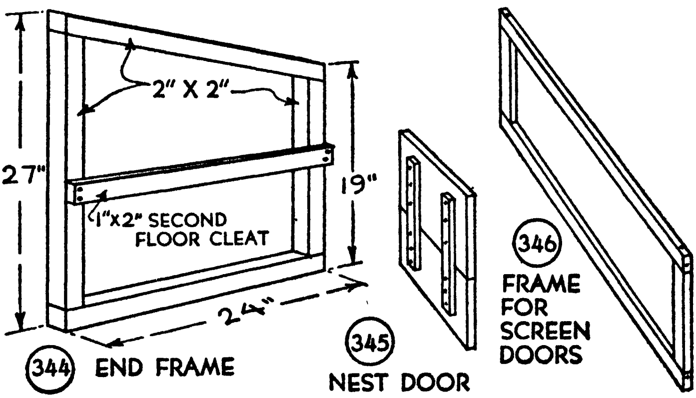


Fig. 344. END FRAME OF HUTCH
Fig. 345. NEST DOOR
Fig. 346. FRAME FOR SCREEN DOORS

connect them with a floor, roof and back boards, board up the ends, and inclose the front, to complete the structure. The end frame is shown built of 2-by-2s. If you cannot get 2-by-2s, build up the ends of boards, instead of making the frames. In that case, fasten together the boards with battens. The solid ends must be sawed off on top to make the right slant for the roof. When you have built the end frames or solid ends, fasten a cleat across each (Fig. 344) to support the second floor boards.

INCLOSING MATERIAL

Crating material will do for inclosing the back, bottom, roof and ends of the hutch, and probably you can get what you need from a plumber or furniture dealer. This material will not make as neat an inclosure as matched boards would, nor as tight a job, but you can cover the outside with roofing paper or shingles to improve the appearance.

THE ROOF

Cut the roof boards of the right length to project a trifle over the ends (Fig. 342) and make the same projection over the front and rear walls (Fig. 343). Roofing felt tacked to the roof boarding, with its edges brought down over the edges of the boards, will make a tight job.

A RAMP

After you have cut the boards for the second floor, saw a piece 3 inches wide and about 12 inches long out of the rear board to admit the ramp or stairway. Then, when you have nailed the floor boards to the end cleats, make a ramp of a board with cleats nailed across it about 3 inches apart (Fig. 342) and fasten the board to the first and second floors with hooks, or otherwise, so that you can remove it easily when you clean the hutch.

THE NEST COMPARTMENT

Cut a board of the right size for the nest compartment partition, saw a doorway in it about 3 inches wide and 5 inches high, and fasten this partition between the floors 12 inches from one end of the hutch.

THE FRONT INCLOSURES

It is best to have the front of the hutch inclosed with hinged frames that you may open to gain access to all parts for cleaning. Fasten a 1-by-2 strip across the front of the hutch, close to the roof, for a hinge strip, and fasten another on a level with the second floor, for a meeting rail.

THE NEST COMPARTMENT DOOR should be solid. If you cannot get a board of the right width, batten two pieces together as shown in Fig. 345. Hinge this door at its top and provide a hook to hold it when it is swung open.

THE HINGED FRAMES should fit loosely in the openings. Make them of 1-by-2s and cover them on the inside with 1-inch poultry netting. Hinge them as shown.

KNOBS AND LOCKS. Fasten thread spools to the door and frames for knobs, and screw iron buttons to the center rail for catches.

Add a hinge hasp and padlock to the door and to each frame to prevent anyone from molesting your rabbits.

PAINT AND DISINFECTANT

When you have completed the hutch, give the outside two coats of oil paint and the inside a coat of a disinfecting whitewash.

Chapter XXVI

ARCHERY CRAFT

Refinements in Homemade Archery Outfits—Selected Stock for Bow—Making the Bow—The Bowstring—Arrows—A Bracer—A Shooting Glove—A Target—A Target Tripod

WITH increased interest in archery, there have come refinements in homemade outfits and I am going to show you in this chapter how to make a first-class bow, arrows that will hit the bulls-eye, and a regulation target. With this outfit, you Boy Scouts will have no difficulty in earning the coveted merit badge for archery, and those of you who are not Scouts will find archery so fascinating that you will want to join an organization sponsoring this fine sport.

Much of the data in this chapter has been obtained from Scoutmaster John P. Kilboy, Troop No. 752, Chicago, who has specialized in homemade archery tackle and is an expert in shaping bows and arrows.

SELECTED STOCK FOR BOW

No longer will any ordinary springy stick meet the specifications for a bow. The wood must be of selected stock. *Yew* is first choice. *Osage orange* is rated second, *lemon wood* third, then *hickory* and *white ash.* You can probably get either of the latter

two woods through a local lumber dealer. Lemon wood staves $1\frac{1}{8}$ inches square and 6 feet long can be obtained from the Department of Scout Supplies, Boy Scouts of America, and they are recommended as the best material available, of selected stock.

MAKING THE BOW

LAYING OUT. Figure 347 shows what your completed bow should look like, when strung for use. Figure 348 shows a stave marked out for the first step in shaping. Draw a center line from end to end, along two opposite faces of the stave. One of these faces, the back of the bow, should be the side that was outermost in the original log (determine this by the end grain). Locate the center of the length of the stave, and scribe a line around the four sides 1 inch to the left of this point, and another line 3 inches to the right of the point, to locate the handle. Then scribe the tapering side lines, from points 4 inches each side of the handle to points $\frac{5}{16}$ inch each side of the end centers.

CUTTING. Rip the stave close to these lines, plane up and smooth with sandpaper. The stave will now have the form of Fig. 349. Next, mark off the side edges of the stave, as indicated by dotted lines in Fig. 349, and cut to these lines (Fig. 350).

THE FINAL SHAPING. The efficiency of the bow will depend upon the nicety with which you do the final shaping. The front, or belly, of the bow, must be rounded. Figure 351 shows a cross section of the handle, Fig. 352 a cross section each side of the

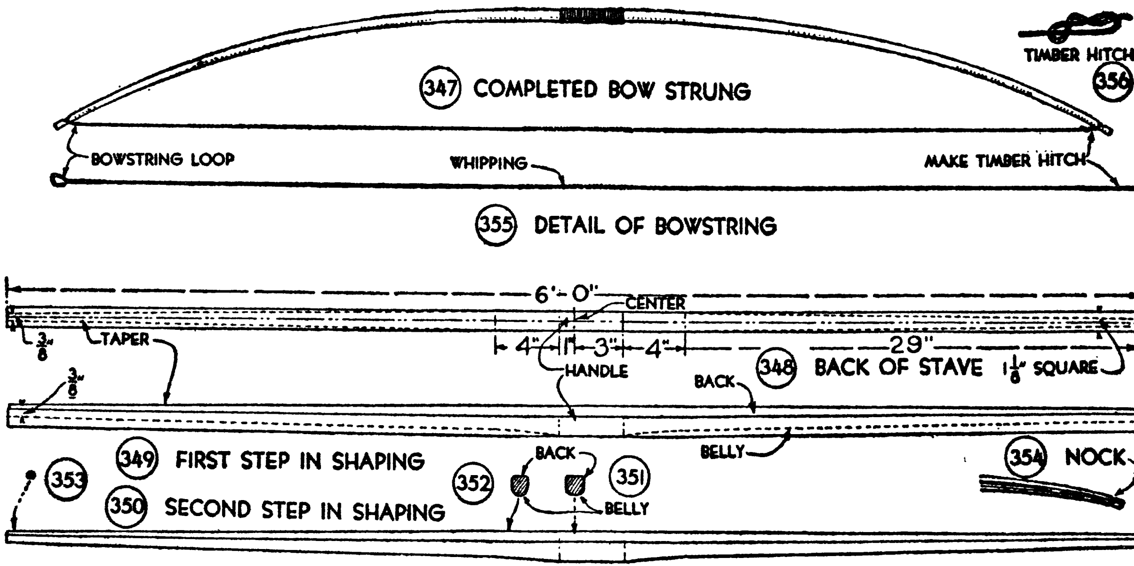


FIG. 347. THE COMPLETED BOW, STRUNG
FIG. 348. STAVE MARKED OUT FOR RIPPING
FIGS. 349-350. SHAPING THE BOW
FIGS. 351-353. CROSS SECTIONS OF BOW

FIG. 354. DETAIL OF NOCK
FIG. 355. DETAIL OF BOWSTRING
FIG. 356. TIMBER HITCH

handle and Fig. 353 a cross section at the tips. Use a plane, wood rasp, steel scraper and sandpaper for shaping. No. 00 sandpaper is right for the final smoothing. Make frequent tests while shaping, to determine whether the bow ends bend properly.

THE END NOCKS. When you have become proficient in bow making, you will want to inlay the back of the bow, shape horn tips for the *nocks*, and add other refinements. But your first bow should be a plain job, and nocks cut in the tips, as shown in Fig. 354 will do. Cut them with a rat-tail file.

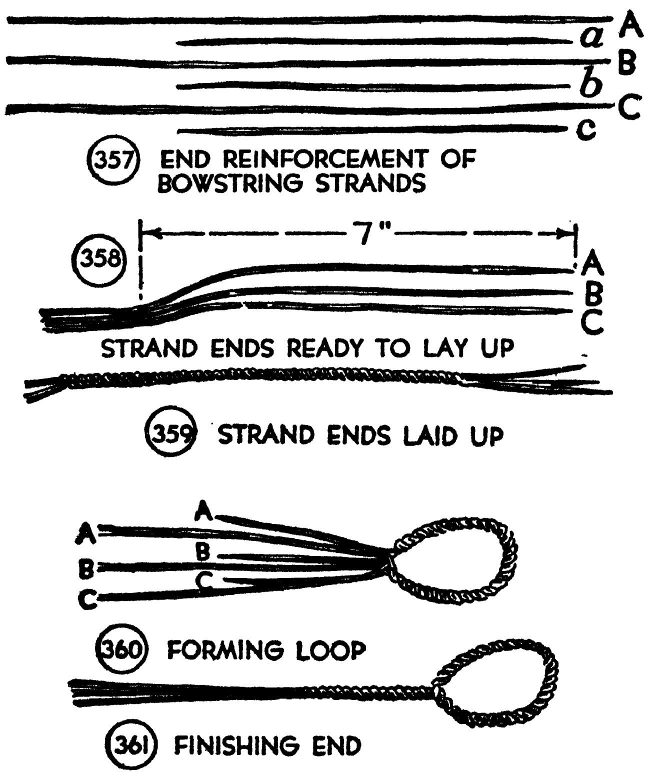
FINISHING. Finish your bow with clear lacquer. Two coats will do, but three coats will make a finer job. After each coat has dried, rub down the surfaces with a piece of cheesecloth dipped in shellac, with a few drops of machine oil added. Rub with and across the grain, until a satin finish has been obtained. Tip the bow ends with black or aluminum paint, as a finishing touch. Whip the handle with cord, or glue a piece of leather around it.

THE BOWSTRING

Now for the bowstring (Fig. 355). Build this up of shoemaker's No. 12 linen thread, waxed with pure beeswax. Make three strands of twelve threads each. To measure off the thread, run it around two nails placed 7 feet apart. Wax each thread, then each strand. This makes the threads stick together.

REËNFORCE THE STRAND ENDS, the upper end for the *loop*, the lower end for the *hitch*. To do this, make

three short strands of six threads each, 12 inches long and wax them together. Reduce the thickness of the strand ends by scraping them with a dull



FIGS. 357-361. DETAILS OF BOWSTRING

knife to make them taper. Then place the short strands (a, b, c, Fig. 357) along the ends of the long strands (A, B, C) and wax these to them.

LAYING UP THE STRANDS. The strand ends are now ready to lay up as a rope is laid. Hold the three

strands at a point about 7 inches from the ends (Fig. 358), then taking hold of the end of one strand (A), twist it away from you, and draw it toward you over the other two strands (B and C). In the same way, twist strand B away from you and draw it toward you over strands C and A, then twist strand C and draw it over strands A and B, and continue the twisting and laying in this manner until enough length has been laid up for the loop (Fig. 359). Form the loop (Fig. 360), and wax each end to its strand (A to A, B to B, and C to C) at the point where the loop is closed. Then continue laying up the ends for a short distance beyond (Fig. 361).

Separate the strands, by combing out the twists with your fingers, so that they lie parallel to one another. Then proceed to lay up the lower end of the string, in the same way that you laid up the loop end, but make no loop. This end is to be attached to the lower nock with a *timber hitch* (Fig. 356).

To complete the bowstring, wax the three strands together from loop to lower end, and rub briskly with a cloth. The friction produced will melt the wax and unite the strands into a firm cord. Twist slightly to make the string round. Whip the bowstring with No. 50 linen thread, at the center, for a distance of about 8 inches, and wax the thread.

ARROWS

Stock for Shafts. An arrow must be absolutely straight and it must have sufficient stiffness so that

it will not buckle (Fig. 362). You will find nothing better for shafts than 5/16-inch birch or maple dowel-sticks (Fig. 363) which can be purchased at most hardware stores. Your dealer's stock will contain crooked, knotty sticks, but tell him the purpose for which you want them and he will probably permit you to make a selection.

THE LENGTH OF THE SHAFT should be between 25 and 28 inches, according to your draw. You will have to determine this for yourself.

MAKE THE NOCK, shown in Figs. 364 and 365, with the edge of a flat file, cutting it to a depth of about 1/4 inch. Smooth the nock with sandpaper and round the shaft end slightly.

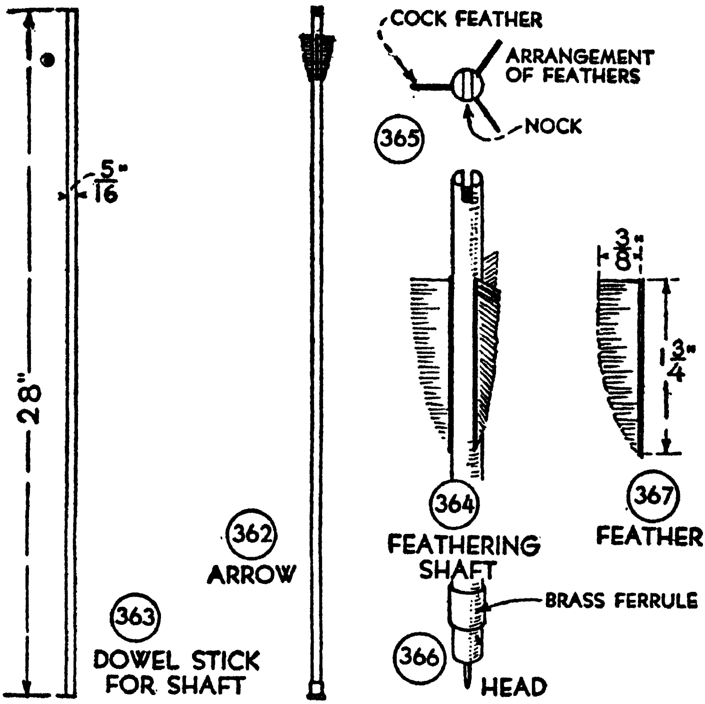
ARROW HEADS. A head commonly used for home made arrows is a pistol cartridge shell of 38 caliber (Fig. 362). This is attached to the shaft by denting the side of the shell with the end of a nail. Some arrow makers weigh the head by slipping a flattened BB shot into the shell before mounting.

A pointed tip that will penetrate is necessary for shooting at straw targets. It can be made by fitting a piece of 5/16-inch brass tubing over the shaft end, for a ferrule (Fig. 366), then driving a finishing nail into the exact center of the end and filing off the nail head.

Regulation steel points and ferrules can be purchased from dealers in archery supplies.

FEATHERING THE SHAFT. Feathering is the most exacting part of arrow making. Turkey feathers are best for the job. You can buy them from the Supply Department of the Boy Scouts of America.

Figure 367 shows dimensions commonly used for arrow feathers. The length may be reduced to 1 inch and the height to ¼ inch, for distance shooting.



FIGS. 362-364. DETAILS OF ARROW SHAFT AND HEAD
FIGS. 365-367. DETAILS OF FEATHERING

Split the quill with your jack knife, cut off the lengths of feather wanted, and cement the three pieces to the shaft. Place one feather at right angles to the nock (Fig. 365), the other two so that the three are spaced equidistantly. A safety razor blade is handy for trimming the feathers.

FINISHING. Finish arrow shafts with lacquer, in color if you like, and rub them down with a cloth

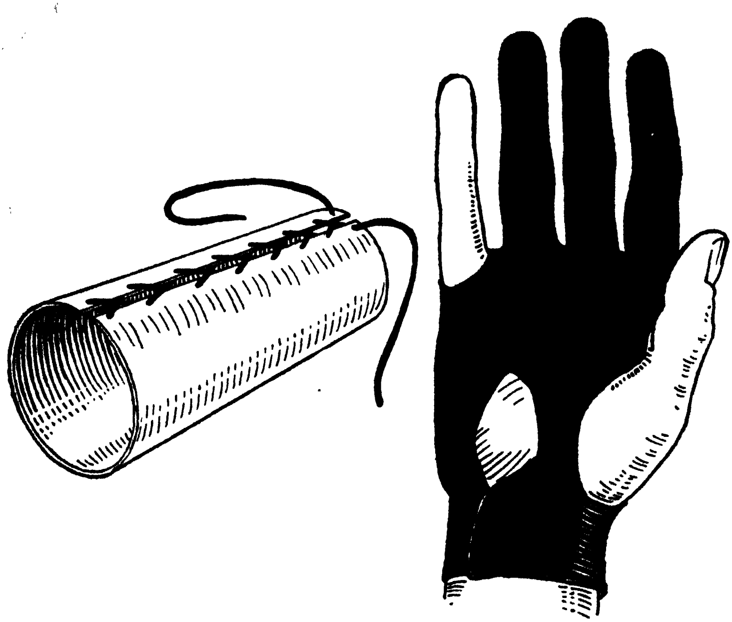


FIG. 368. BRACER
FIG. 369. SHOOTING GLOVE

dipped in shellac and oil, as suggested for finishing the bow.

A BRACER

A bracer or arm guard is necessary to protect your left arm from the blow of the bowstring. Make it of leather, about 4 inches long, with edges punched and laced as shown in Fig. 368.

A SHOOTING GLOVE

Figure 369 shows a shooting glove for the right hand, made of a leather glove with the thumb and little finger removed. The glove fingers may be re-enforced with patches of leather.

Photograph Fig. 370 shows Scout Joseph Brack and his homemade archery outfit.

A TARGET

Photograph Fig. 371 shows a homemade straw target that is not hard to weave and cover. This is a 48-inch target, tournament size. You may make yours smaller, reducing the target rings proportionately.

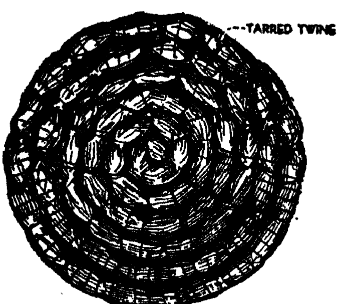
Rye straw is best for the job, but wheat or oat straw will do if you cannot get rye. Buy a ball of strong tarred twine for binding the straw into rope.

The straw mat is shown in photograph Fig. 372 and detail Fig. 373. Begin it by splicing the straw to form a rope 4 inches in diameter. Press the straw together to make it compact, and bind it every few inches with the tarred twine (Fig. 374). If you can get an upholstering needle, it will simplify the stitching of the strands. When you have made several yards of the rope, make a tight coil of it, stitching the turns to those adjoining. Then make as many additional lengths of rope as are necessary, and add them to the coil. When the right diameter has been obtained, go over the mat with needle and twine and

reënforce the stitching at every point where there is a lack of firmness, and add stitches to the last turn of the coil, with a spacing not over $1\frac{1}{2}$ or 2 inches.

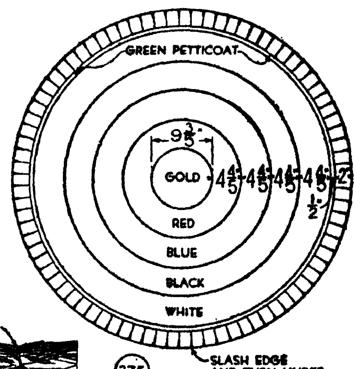
A BURLAP COVER will help to hold the mat intact. Fit it snugly over the sides and edges and sew it.

THE TARGET FACE requires a good grade of table oilcloth. A layout for the rings is given in Fig. 375.



373 STRAW MAT

374 STRAW ROPE



375 LAYOUT FOR TARGET FACE

FIGS. 373-374. DETAILS OF STRAW MAT FOR TARGET SHOWN IN PHOTOGRAPHS FIGS. 371 AND 372
FIG. 375. LAYOUT FOR TARGET FACE

To simplify the fractional measurements, you may make the width of the *bulls-eye*, or *gold*, $9\frac{1}{2}$ inches in diameter, and the rings $4\frac{3}{4}$ inches wide. A strip of cardboard with a pin near one end, and holes punched at the correct distances apart, for a pencil to stick through, makes a good compass for describing the target rings.

When you have laid out the face, fill in the bullseye with radiator bronze, the other rings with enamel

FIG. 370. A SCOUT AND HIS HOMEMADE BOW

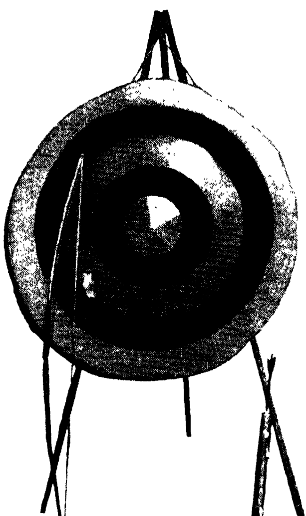
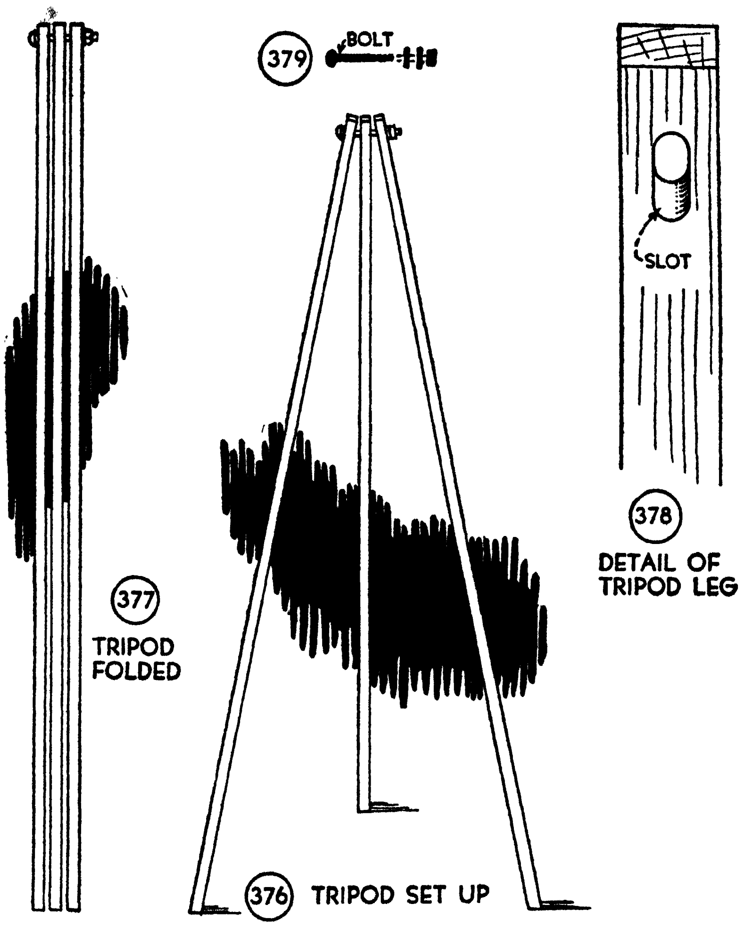


FIG. 371. A HOMEMADE TARGET
FIG. 372. WOVEN STRAW MAT FOR TARGET



FIGS. 376-379. DETAILS OF TARGET TRIPOD SHOWN IN PHOTOGRAPH FIG. 371

paint of colors specified in Fig. 375. Outside of the white ring is a narrow ring of green, known as the *petticoat.*

Do not trim off the oilcloth on the line of the petticoat. Leave a margin of 2 inches outside of it, slash this as indicated in Fig. 375 and turn it under to reenforce the edge.

To MOUNT THE TARGET FACE, punch a row of holes 2 inches apart around the edge, inside the petticoat, and stitch the face to the straw mat.

A TARGET TRIPOD

Figure 376 shows an excellent target tripod. It is made of three 1-by-2 strips 7 feet long, bolted together at the top so that they may be folded compactly as shown in Fig. 377. Bore ½-inch holes through the strips near the top, for a bolt, and make slots of the outer holes, as shown in Fig. 378. This is necessary to provide for the spreading of the tripod legs. Use a ½-inch bolt, washers and nut (Fig. 379) for assembling the tripod.

Chapter XXVII

A LEAF WAIN

Helpful When You Groom the Lawn in the Fall—Made of a Bundle of Laths—The Chassis—The Body—The Assembly—Finishing

If it is your job to groom the lawn in the fall, and I imagine that Father shows a willingness for you to assume the responsibility, you will find the wain in use in photograph Fig. 380 a great help in gathering up and disposing of the leaves. The only materials required to make it are a wheelbarrow, a bundle of 48-inch laths, costing about 55 cents, a nickel's worth of lathing nails and a handful of 10-penny nails.

THE CHASSIS

Photograph Fig. 381 shows a detail of the completed body, and photograph Fig. 382 shows the chassis, a wheelbarrow chassis with the tray removed. If you have a wheelbarrow with a steel tray you can easily remove the tray by unbolting it. The wain body may be bolted, but since it is shaped to fit the frame this is not necessary. When the last of the leaves have fallen and you have given the lawn its final raking of the season, hang up the wain body in the garage or basement and rebolt the barrow tray to the chassis.

THE BODY

Figure 383 shows a detail of the completed wain. Figure 384 shows the bottom frame of the wain body. The frame has been laid out to fit the chassis of a wheelbarrow of average size. Check the measure-

FIG. 383. DETAIL OF WAIN SHOWN IN PHOTOGRAPH FIG. 380

ments with your own wheelbarrow. Complete the bottom frame with lath crosspieces spaced about 1 inch apart, as shown in Fig. 387.

THE FRONT AND REAR FRAMES are shown in Figs. 385 and 386. Pieces of scrap lumber will do for the battens. Place the battens upon the ground or workbench with the ends spread as shown. Then nail laths across them with a spacing slightly more than the

FIG. 380. THE WAIN IS A HELP WHEN GROOMING THE LAWN

FIG. 382

FIG. 381

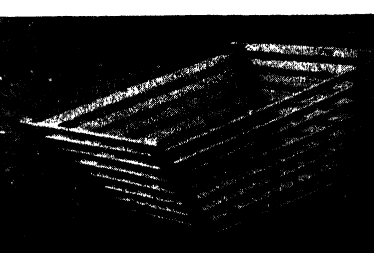
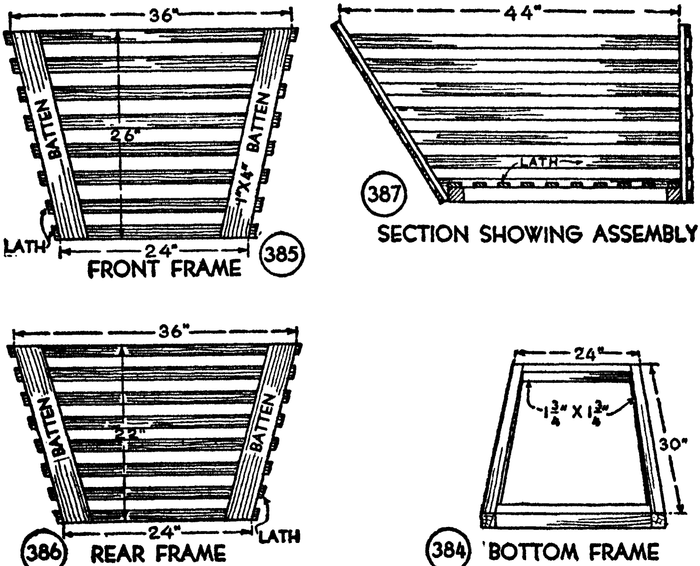


FIG. 381. DETAIL OF WAIN
FIG. 382. CHASSIS

width of a lath. Cut two spacer blocks of spacing width and slip them between the lath ends as you place and nail the laths. Leave the trimming of ends



FIGS. 384-387. DETAILS OF FRAMES FOR WAIN, AND THEIR ASSEMBLY

until you have completed the nailing. Trim so that the projection over the battens will be about ½ inch.

THE ASSEMBLY

When you have made up the front and rear frames, fasten them to the ends of the bottom frame, with the rear frame vertical and the front frame inclined to the angle of the wheelbarrow chassis frame (Figs. 381 and 387). The inside length is given as 44 inches.

This measurement will vary with different wheelbarrows, therefore it requires checking. Complete the assembly by nailing the side laths. Slip the side laths between the ends of the front and rear frame laths, and trim flush with these frames.

FINISHING

A coat of shingle stain, green or brown, or a coat or two of paint will make a finished job.

Chapter XXVIII

AN OUTDOOR HALLOWE'EN PARTY

The Outdoor Party Avoids Complications—The Abandoned Graveyard by the Creek—Laying Plans for the Hallowe'en Party —The cry of "Skunk" at the Edge of the Woods—The Campfire Circle—The Legend of the Inventor—The Phantom Machine Shop —To the Rescue of the Skeleton—The Living Skeleton a Striking Costume—To Make the Skeleton Costume

IT WAS to get away from appointing a detail to pick up apple cores and paper, and possibly to mop up the gymnasium floor, and to escape liability for the breakage of glass, desks, chairs and other school property, which became a thousand per cent more fragile in anticipation of assembling a hundred Boy Scouts to celebrate Hallowe'en, that the program committee decided on a party outdoors where admonitions might be dispensed with and joy be unconfined.

THE ABANDONED GRAVEYARD BY THE CREEK

A small plot of ground along the creek on the outskirts of town had been talked of as a desirable site for a Scout cabin for week-end camping. Once a cemetery, still recorded as such in fact, this half acre had passed through a period of disuse close to a century, and it had become overgrown with scrub trees, shrubs and underbrush. It might be condemned for

a park site, and the park board promised to take action.

One of the arguments advanced in favor of the abandoned grave yard for a camp site was that it might be a quieting influence at night on the restless members of the Troop. But the suggestion immediately acted on, which concerns this narrative, was to hold the outdoor Hallowe'en party on the meadow, adjoining and some twenty feet below the cemetery.

LAYING PLANS FOR THE HALLOWE'EN PARTY

From the school to the cemetery there would be a two-mile hike through town, across fields, over the golf course and through a small woods, which would afford opportunity for stunts along the way. Accordingly, Scouts and Scout candidates were instructed to report at the Elmhurst grade school on the evening of October thirty-first, and were left to surmise that an indoor program was impending.

Since Scouts carry staves on hikes, a bundle of mill trimmings four feet long was obtained and given to a Scoutmaster for distribution. He conceived the idea of driving the sticks into the ground in a Troop Committeeman's garden, and needless to say when it was suggested that the Scouts raid the garden, they pulled up the sticks in great glee.

THE CRY OF "SKUNK" AT THE EDGE OF THE WOODS

With the revelry in full swing, the Scouts made off with their sticks. At the edge of the woods sepa-

rating the town from the old graveyard, there arose a cry of "Skunk!!" and the cry was picked up by all. There was sufficient reason for the alarm, for preceding the arrival of the leading Scouts, carbon disulphide, quite the most unpleasant smell one meets anywhere, had been poured over newspapers and the newspapers scattered where they were certain to give off powerful whiffs of the chemical.

Scouts were sent singly through the woods, along several blazed trails, lighted by candles where specific instructions for procedure were necessary. Phosphorescent faces, skulls, crossbones and various hieroglyphics, and noises made by electric buzzers, alarm clocks and a home-made wind machine, greeted the Scouts at different points of the trail. Then as each emerged from the woods he came upon a pail of apples. No invitation was necessary to help one's self. But one apple sufficed, since the pail also contained water surcharged with current from an induction coil.

THE CAMPFIRE CIRCLE

A rousing fire greeted the Scouts when they reached the meadow adjoining the old graveyard, and the moon was full. All joined the campfire circle. Eats were passed. Hallowe'en stunts were performed. Then there followed hair-raising ghost stories and among them the following told by a genial Scoutmaster, who did not realize what the climax of his story was to be.

THE LEGEND OF THE INVENTOR

This, briefly, was the legend concerning the founder of the abandoned graveyard, an inventor, who it was not generally known, had invented the first automobile, had perfected a wireless telegraph outfit several years before Marconi was born, indeed, is yet to be known as the father of television. He had to his credit the first flight in an airplane, also his last, for the plane had cracked up and he had died of a broken neck. This inventor had often stated a preference for machines rather than a golden harp, and his will had provided for the erection of a large tomb in the cemetery with his tools and other shop equipment placed beside his body.

Instead of building the tomb, the son of the inventor hauled the tools and machines to the cemetery and dumped them in a shallow ravine, starting what is now the town dump. Upon arriving with the last wheelbarrow load, he was startled by the sound of clanking iron, then was horrified to see a skeleton sorting over his father's tools. He nearly collapsed. It was his father's skeleton, none other. He realized now his ingratitude to his father in not carrying out the wish expressed in his will. He was too frightened to speak. He fled.

THE PHANTOM MACHINE SHOP

Thereafter, the clanking of iron and nightly visions of a skeleton became current. People shunned

the spot. No more burials were made there. Only last night, the Scout committee, armed to the teeth, believing that the skeleton might still work in his phantom machine shop, visited the graveyard to reassure themselves before bringing the Scouts here for the party, and while reconnoitering heard the unmistakable ringing of a hammer on an anvil, screeching of a planer, singing of a saw, whirring of a lathe, slam banging of a punch press, humming of motors. Then. . . .

The scoutmaster stopped suddenly, gave a peculiar gasp, his face turned white, his eyes bulged from their sockets. The Scouts turned and knew the reason. There, making its way down the path from the graveyard, jumping, dancing, waving arms in the air, was a lifesize skeleton, nothing cardboard about it, either. The situation was tense. Then, a dozen Scouts arose from the campfire circle and with the instinct of self preservation, grabbed their sticks, made for the skeleton, and beat madly upon his skull.

TO THE RESCUE OF THE SKELETON

The Scoutmaster came to his senses, and with a realization that something had been put over on him, in this presentation, went to the rescue of the skeleton just in time to prevent compound fractures of his bones.

The Troop never heard the last of the Scoutmaster's story . . . neither did the Scoutmaster.

THE LIVING SKELETON A STRIKING COSTUME

The living skeleton is one of the most striking of home-made costumes, and it is not difficult to rig up. It is more effective at a distance than at close range, though with proper lighting it can be exhibited upon a stage or in a large room. In the close-up photograph (Fig. 388) you will notice that the body of the person wearing the costume is in evidence, while in the group photograph (Fig. 389) all but the bony structure of the skeleton melts into the background. In the full of the moon, nothing but the bones had been visible as the skeleton descended from the old cemetery, and the sight was startling even to me, who had planned the stunt and kept it a secret from all except my brother who performed the part of the skeleton.

TO MAKE THE SKELETON COSTUME

Use old clothes, a pair of trousers and a coat or shirt, of dark material, and large enough to fit the body loosely. Overalls and a jumper will do nicely.

The Bony Structure. Spread the clothes upon the floor, and with chalk outline the bony structure of the skeleton upon the cloth, using photograph Fig. 388 as a guide. Then fill in between the chalk lines with a brush and white paint.

For feet pull furnace gloves over the shoes. These make rather deformed looking feet, you may say in examining photograph Fig. 388, but they do

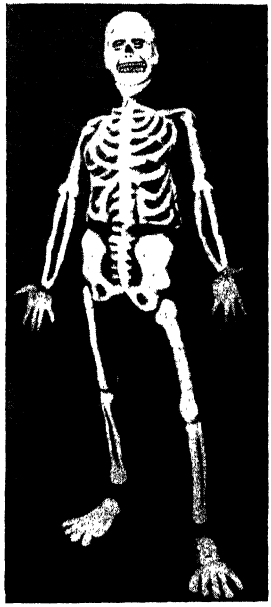


FIG. 388. THE BODY OF THE SKELETON WAS OBSCURED BY THE BACKGROUND, EVEN THOUGH IT WAS BRIGHT MOONLIGHT

FIG. 389. THE TROOP NEVER HEARD THE LAST OF THE SCOUTMASTER'S STORY . . . NEITHER DID THE SCOUTMASTER

well enough. They may be improved upon, however, by painting the bones of the feet upon a pair of black shoes.

THE HANDS also require a pair of furnace gloves.

THE HEAD requires a muslin cap to fit the forehead closely, and to come down over the ears. White grease paint and a black eyebrow pencil are needed for make-up. The photograph suggests the markings.

LUMINOUS PAINT makes the skeleton costume more effective. It can be purchased from mail order houses whose ads you will find in magazines. Apply it after the white paint has dried, following the printed directions that accompany it.

PART IV

WINTER OUTDOOR HANDICRAFT

Chapter XXIX

SKATE SAILS

Skate Sailing Is Packed with Thrills—The Cost of Equipment Is Small—A Sail for Icy Pavements—Handling the Small Sail—A Larger Sail for the Skating Pond—Managing the Sail

SAILING over the ice at the speed of the wind, with your body as mast to support the sail, is a sport packed with thrills matched by few other winter activities. And the necessary sail equipment can be rigged up at a small cost for materials.

A SAIL FOR ICY PAVEMENTS

You might not credit the small skate sail in Fig. 390 with having the specifications for good performance, but with any kind of wind it will carry you along at a merry clip. It is just the rig for sailing over icy pavements and small ponds where the spread area of the sail must be limited. There is not much work making the sail, as you will see by Figs. 391 and 392.

THE SAIL FRAME requires two spars 7/8 inch square, one 3 feet long, the other 5 feet long. Of course, if you do not find sticks of this width and thickness, you can rip them from a board, or you can use wider sticks. Round off the edges with your plane and

sandpaper all surfaces smooth. Then nail the short spar at its center to the long spar and brace with two pieces of lath placed across them as shown.

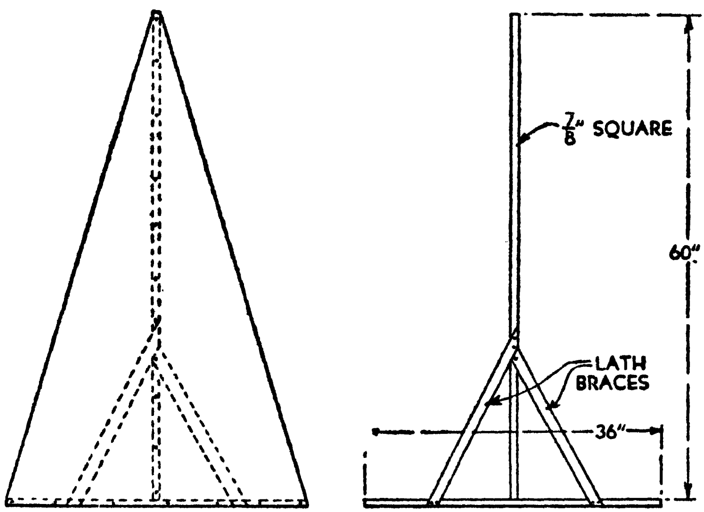
COVERING THE FRAME. Unbleached muslin is the best covering material, but an old sheet will serve

FIG. 390. A SMALL RIG FOR ICY PAVEMENTS

the purpose. If you place the cloth so that the selvage lies along a side edge of the sail, only one edge needs to be hemmed, because the third edge is to be tacked along the shorter frame spar. After tacking the sail to the spar, fasten the peak to the top of the longer spar (Fig. 391).

HANDLING THE SMALL SAIL

When you use this sail, adjust the angle at which you hold it to suit each change in the direction of



391 FRONT OF SAIL 392 SAIL FRAME

FIGS. 391-392. DETAILS OF THE SMALL SAIL

sailing. It may take a few minutes to get the hang of it, then the handling will be instinctive with you.

A LARGER SAIL FOR THE SKATING POND

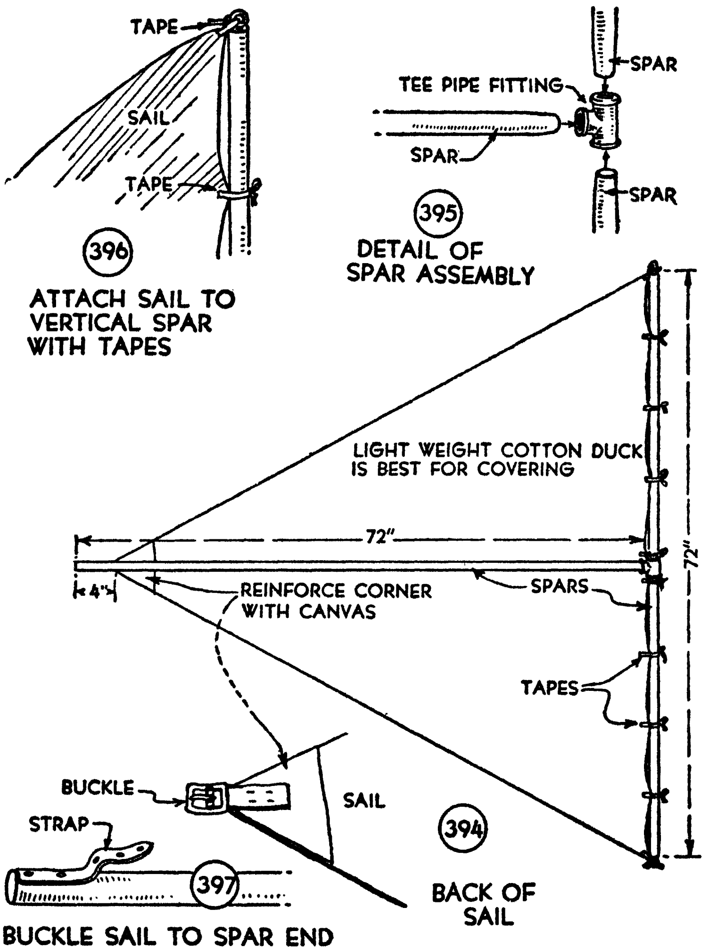
THE FRAME for the sail in Fig. 393 requires one spar 6 feet long and two spars 3 feet long (Fig. 394). Bamboo rug poles, or any kind of rug poles, or cur-

tain poles, or saplings between 1 inch and 1½ inches in diameter will do for the spars. A tee pipe fitting is needed for the assembly (Fig. 395). This should be of a size that the spars will fit, but if it is smaller

FIG. 393. A LARGER RIG FOR THE SKATING POND

the spar ends may be whittled down so that they will drive in. With the spars assembled in this way, the sail frame can be knocked down and made up with the sail in a compact roll for carrying to and from the skating pond.

COVERING THE FRAME. Cotton duck of 8-ounce



FIGS. 394-397. DETAILS OF THE LARGER SKATE SAIL

weight is best for a sail of this size. Two yards, cut diagonally, will be sufficient. Place the two triangular pieces together, and ask Mother or Sister to sew them with an interlocked seam; also, to hem the three outside raw edges.

THE SAIL FASTENINGS. Sew tapes to the edge of the sail that lies along the vertical spar, for fastenings (Fig. 396). Get a short strap for the point of the sail. Cut off the end 1 inch or so below the buckle, and sew this buckle end to the sail as shown in Fig. 397. Then tack a length of 8 inches of the strap to the stern end of the horizontal spar. You can pull the sail taut by means of this strap fastening.

MANAGING THE SAIL

The manner of holding the sail when sailing before the wind is shown in Fig. 393. Shift the sail from shoulder to shoulder, and change your hand holds as is necessary to catch the wind.

Chapter XXX

AN ICE YACHT

Ice Yachting Can Be Enjoyed by Every Boy—A Knock-Down Frame Can Be Transported to and from the Ice Course—The Framework—The Cockpit—Ice Skate Runner Shoes—The Rudder and Tiller—Steel Runner Shoes—The Mast, Boom and Gaff—The Mast Step—The Sail—The Rigging

YEARS ago ice yachting was known only to boys who lived near lakes and rivers, but the automobile changed that scheme of things, and almost every boy can now enjoy the sport, using a craft with a knock-down frame that he can transport to and from the ice course with the family car or a friend's car. The yacht in Fig. 398, also shown in photograph Fig. 408, is a job well suited to the purpose, and it is a practical little ship with a record for good performance.

THE FRAMEWORK

THE MATERIAL. The framework, shown in detail in plan Fig. 399, requires a piece of pine 2-by-6 10 feet long for the *reach* and *mast step*, a piece of 2-by-4 6 feet long for the *crossbeam*, a piece of 2-by-2 5 feet 5 inches long for the *bowsprit*, a piece of oak or hard pine 2-by-4 6 feet long for *runner blocks* and *cockpit braces*, a piece of veneer (crating material will do) for the *cockpit seat*, and a piece of 2-by-2

5 feet long for *hand rails*; also, galvanized twisted wire clothesline for *stays*, four *turnbuckles*, six galvanized *pulleys*, *screw hooks*, *screw eyes*, a *cleat* and bolts of the sizes specified, for the assembly.

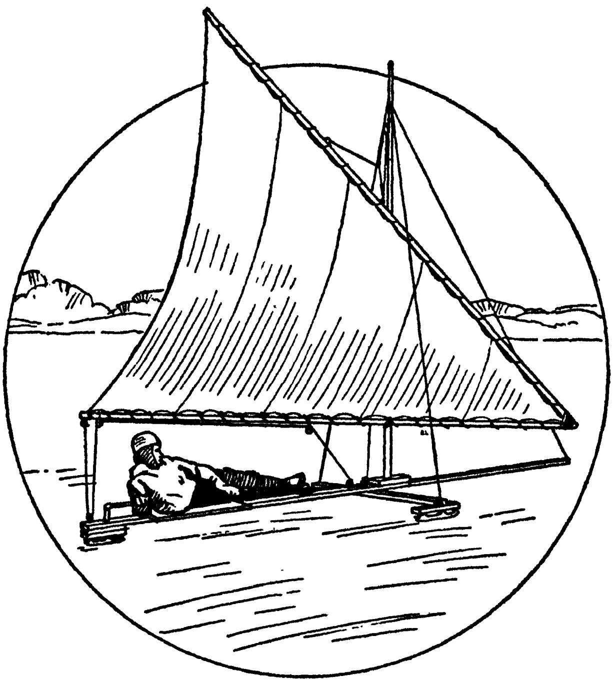


FIG. 398. DETAIL OF ICE YACHT SHOWN IN PHOTOGRAPH FIG. 408

ASSEMBLING. Bolt the crossbeam to the reach plank at right angles, 10 inches from the bow, with three $\frac{5}{16}$-inch bolts 4 inches long, and strap the bowsprit to the under side of the bow of the reach with a pair of iron straps, as shown in Fig. 400. Drive $2\frac{1}{2}$-inch screw hooks into the reach, crossbeam and

bowsprit where shown, and cut pieces of the wire clothesline into the right lengths for framework stays, joining a turnbuckle to one end of each, and

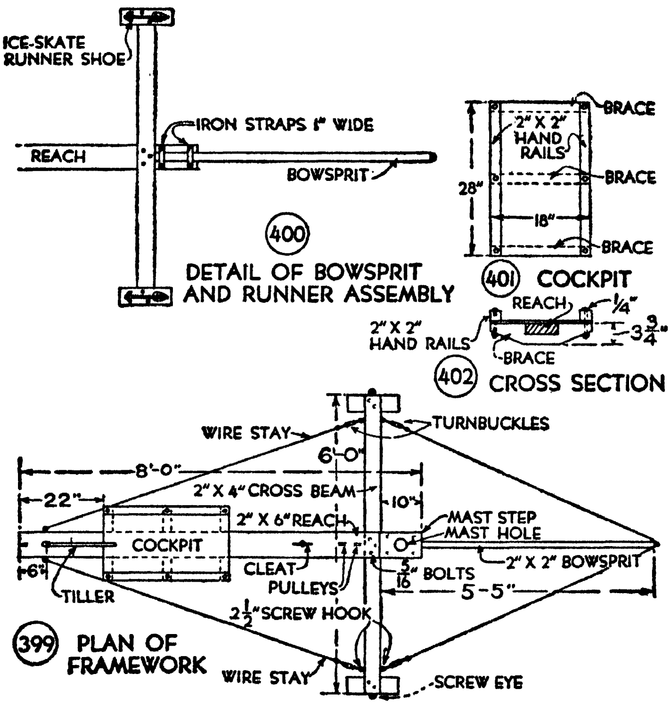


FIG. 399. PLAN OF FRAMEWORK
FIG. 400. DETAIL OF BOWSPRIT AND RUNNER ASSEMBLY
FIGS. 401-402. DETAILS OF COCKPIT

forming an eye in the other end. Slip the stays over the hooks, and make them taut with the turnbuckles, being careful to take them up an equal amount in order not to twist the framework out of shape.

THE COCKPIT

Cut the plywood cockpit seat 18 inches wide and 28 inches long, and the 2-by-2 hand rails 28 inches long (Fig. 401). Cut a pair of 2-by-4 braces with

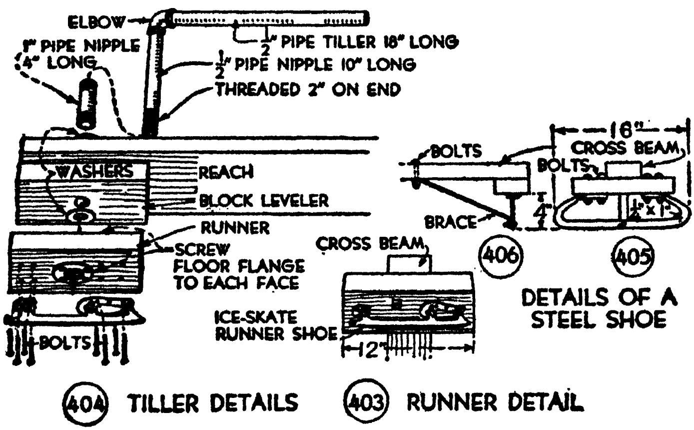


FIG. 403. RUNNER DETAIL
FIG. 404. TILLER DETAILS
FIGS. 405-406. STEEL SHOE DETAILS

ends beveled as shown in Fig. 402, and the center notched over the reach. Nail the plywood to the under side of the hand rails, and bolt the braces at the center and ends with 5/16-inch bolts.

ICE SKATE RUNNER SHOES

The runner shoes may be ice skates. Cut three 2-by-4 runner blocks, and bolt one to each end of the cross beam with 5/16-inch bolts (Fig. 403). Then bolt a skate to each block (Fig. 404).

THE RUDDER AND TILLER

The stern runner is the rudder, and its block must be pivoted as shown in Fig. 404, with a 2-by-4 leveler set in between it and the reach. Bore a ¾-inch hole through the center of each block, and another through the center of the reach 6 inches from the stern. Screw a ½-inch floor flange to each side of the runner block, exactly over the hole, and screw a ½-inch pipe nipple 10 inches long, with one end threaded a distance of 2 inches, through the runner block floor flanges. Slip the upper end of the pipe post through the leveler block and the reach plank, with an iron washer below the block and another washer above the plank. Then slip a 1-inch pipe nipple 4 inches long over the ½-inch post, screw a pipe elbow to the end of the post, and screw an 18-inch length of ½-inch pipe into the elbow for the tiller bar.

STEEL RUNNER SHOES

Figures 405 and 406 show details of a steel runner shoe. This is the shoe used on the craft shown in photograph Fig. 408, and it is the type of shoe attached to most ice yachts in preference to ice skates, which are looked upon more or less as makeshifts. You will not be able to make a set of these shoes unless you have access to a forge, but you can get a blacksmith to shape them at a small cost. The blade should be ground to a sharp 90-degree "V" edge.

THE MAST, BOOM AND GAFF

Make the mast of a Christmas tree or a bamboo rug pole. If you use a tree, lop off its branches, peel the bark and cut to a mast length of 9 feet.

Cut the boom 12 feet long. A bamboo rug pole, obtained at a furniture store, will make a good boom, and another will do for the gaff.

Cut the gaff 13 feet 6 inches long.

THE MAST STEP

The mast step requires a 2-by-6 block 10 inches long. Cut the mast hole through its center, and bolt the step to the bow of the reach, as shown in Figs. 399 and 407.

THE SAIL

Make the sail of 10-ounce cotton duck, following the dimensions given in Fig. 407. Fold the edges of the several widths of cotton duck to form interlocked seams, and sew the seams with double rows of stitching.

Brass grommets should be set into the edges that lie along the boom and gaff, if you can get them. You can easily attach them in this way. Split the canvas, insert a grommet, and place a ball bearing that is a trifle larger than the grommet opening, upon the edge of the grommet. Then hammer upon the bearing until the grommet's edge is turned over,

outward, and finish the clinching with the ball end of a ball peen hammer. Keep the canvas from puck-

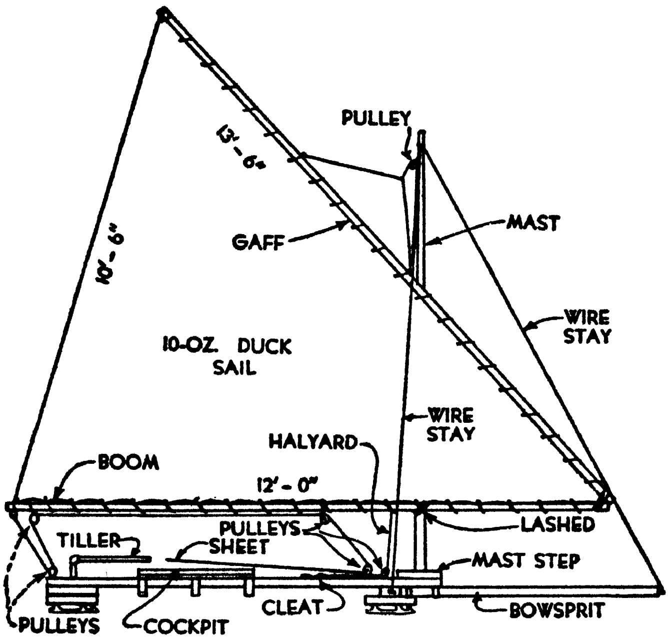


FIG. 407. DETAIL OF RIGGING

ering and you will have as neat a job as can be produced by an eyeleting machine.

THE RIGGING

The lashing of the spars and sail is shown in Fig. 407; also, the placing of the wire stays, pulleys, cleat, halyard and sheet. Use a closely woven clothesline or sash cord for *halyard* and *sheet*.

Chapter XXXI

A BOBSLED

The Automobile Has Brought the Bobsled into its Own—Inexpensive and Easy to Build—The Bow and Stern Sleds—The Bobsled Seat—Hand Rails—Finishing—An Upholstered Seat or Cushions

SEVERAL decades ago, city boys had little or no use for bobsleds, unless there chanced to be a hill within hiking distance, or a livery from which a horse might be borrowed or hired for half a day or evening. Coasters and toboggans were better suited to toboggan slides and artificial hills of city parks. But now that coasting hills are often within a short drive by car, the bob has come into its own. The automobile has also made bobsled hitching great sport, though a dangerous sport except when the bob has brakes and hitching is confined to highways with little traffic.

INEXPENSIVE AND EASY TO BUILD

A bobsled is expensive to buy, inexpensive and easy to build. Photograph Fig. 409 shows a bobsled with a 6-foot reach, that seats three coasters comfortably, and will accomodate four. By the side elevation (Fig. 410), the longitudinal section (Fig. 411) and the plan (Fig. 412), you will see that a bob consists of two sleds joined by a plank seat. The

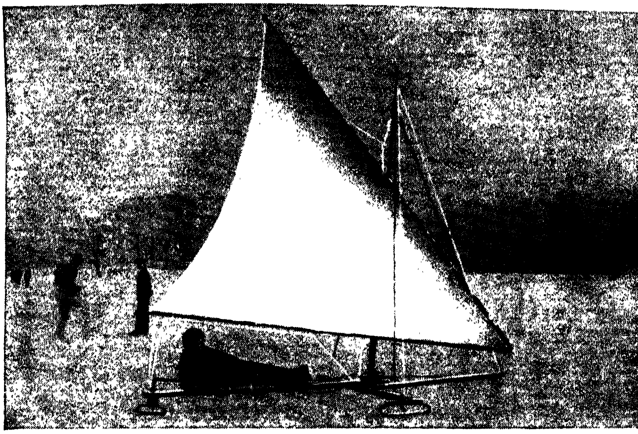


FIG. 408. THIS SPEEDY ICE YACHT HAS STEEL RUNNER SHOES

FIG. 409. ALL SET FOR THE DOWN GRADE

bow sled is pivoted to the plank to provide for steering. The rear sled is pivoted to rise and fall independently of the bow sled when the bob runs over uneven ground; also, when it reaches the bottom of

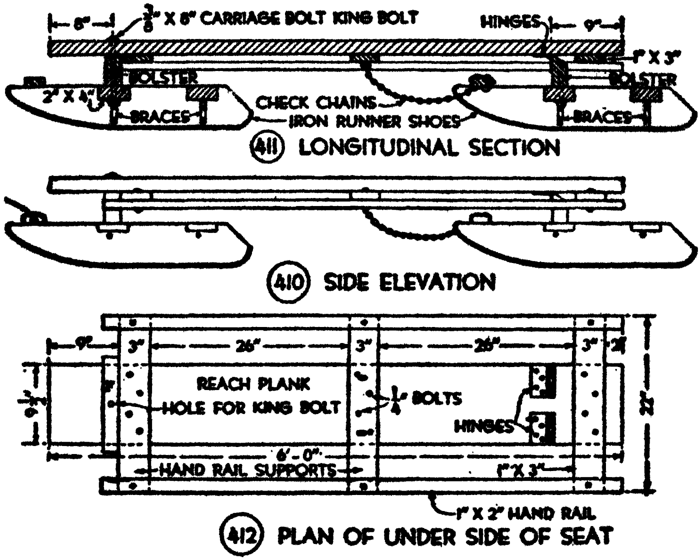


FIG. 410. SIDE ELEVATION OF BOBSLED SHOWN IN PHOTOGRAPH FIG. 409
FIG. 411. LONGITUDINAL SECTION
FIG. 412. PLAN OF UNDER SIDE OF SEAT

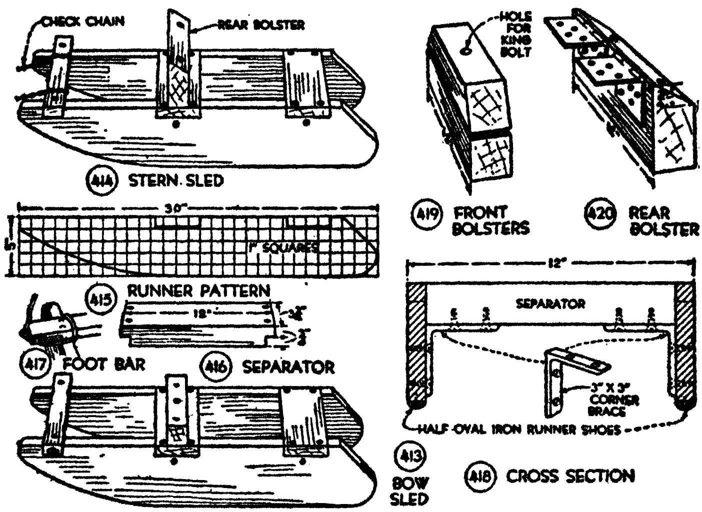
slopes. A bolt pivots the bow sled. Hinges pivot the stern sled and chains hold it in check.

THE BOW AND STERN SLEDS

The first parts of the bobsled to build are the bow and stern sleds (Figs. 413 and 414).

THE RUNNERS may be cut out of 1⅛-inch stock,

preferably hard wood. Thicker stock will make a stronger job, of course, but it will also add weight. Follow the pattern of Fig. 415 in laying them out. It has been ruled off into squares representing 1-inch squares of the full-size pattern, so lay out a similar



FIGS. 413-420. DETAILS OF SLEDS OF BOBSLED

series of squares, measuring 1 inch across, upon cardboard, and draw the runner outlines upon them exactly as drawn upon the printed pattern. The notches in the upper edge are for the ends of the separators to fit in.

Cut out the pattern, trace around it upon the runner stock, and saw out the pieces. Then finish the sawed edges with a plane and sandpaper. A coarse file is handy for finishing the curved ends.

THE SEPARATORS are pieces of 2-by-4 with ends

notched as shown in Fig. 416 to fit the runner notches. Fasten them to the runners with screws (Figs. 413 and 414). Then brace with pairs of 3-by-3 iron corner braces as shown in cross section Fig. 418.

THE FOOT BAR on the bow sled is made of a 1-by-2, and a similar bar on the stern sled provides for the attachment of check chains. Cut notches as indicated, for the steering lines and check chains. Screw screw eyes into the ends of the foot bar and run the steering lines through them as shown in Fig. 417.

SEATS were added to the sleds of the bob in photograph Fig. 409, but were omitted from the sleds of the bob in the working drawings. Provide them or not as you see fit.

RUNNER SHOES make the sleds slide more freely over snow and ice, and protect the wood from wear. What you need for these are strips of ¾-inch half-oval iron long enough to turn up and extend over the runner ends, as shown in Figs. 411 and 418. A blacksmith or hardware dealer will get them for you. Each shoe must have a pair of holes drilled through it near each end, to provide for screwing to the runners. The holes must be countersunk so that the screw heads will set flush with the iron.

THE BOBSLED SEAT

Get a plank 10 inches wide and 6 feet long for the seat.

TO PIVOT THE BOW SLED to this plank, cut a pair of bolster blocks 1¾ inches square and 12 inches long (Figs. 411 and 419), one to bolt to the front separator

of the sled, the other to bolt to the under side of the seat plank. Bore a hole through the center of the length of each block, and through the sled separator, for a ¾-inch king bolt 8 inches long. Place an iron washer under the head of the king bolt, another between the bolster blocks, and a third under the bolt nut.

To Pivot the Stern Sled. The bolster block of the stern sled is a piece of 2-by-4 with its top beveled as shown in Fig. 420. The block is bolted to the sled separator, as shown in Fig. 411. Hinges pivot the seat plank to the bolster. Use 4-by-4-inch steel hinges. Bolt them to the bolster and the seat plank with stove bolts.

Attach the check chains to the stern sled and to screw eyes screwed into the center hand rail crosspiece, as shown in Fig. 411. Make these of a welded chain.

HAND RAILS

Figure 412 shows a plan of the under side of the seat plank. Cut 1-by-3 crosspieces 22 inches long for the hand rail supports and screw them to the seat plank. Make the hand rails of hard wood or iron pipe, and bolt them to the crosspieces.

FINISHING

You will want to paint your bobsled and make it the finest looking job in town. Automobile enamels

make the most durable finish. Apply an undercoat of oil paint.

AN UPHOLSTERED SEAT OR CUSHIONS

You may upholster the sled seat like the bob in photograph Fig. 409, or you may cover it with carpet, bringing it down over the edges of the seat and fastening with large-headed upholstering tacks. Another plan is to ask Mother to make cushions covered with oilcloth and provided with straps to strap to the sled seat. But most home-made bobsleds have neither upholstering nor cushions.

Chapter XXXII

WINTER FEEDERS FOR BIRDS

Winter Feeders as Important as Spring Houses—A Suet Container—A Suet Coil—A Shelter Feeder—Finishing

IT IS quite as important to provide food for winter birds and the early spring arrivals from the south, as to set out houses for the nesting season. Feeding requires little time and you will feel many times repaid in watching the results of your benefaction. Of course, if you undertake this service, you must be regular about the food supply. With bare ground and moderate weather, birds can subsist on the remains of last summer's crop of seeds and berries on vines, stalks and bushes, but when these are buried by snows, your assistance will be all that will stand between them and starvation.

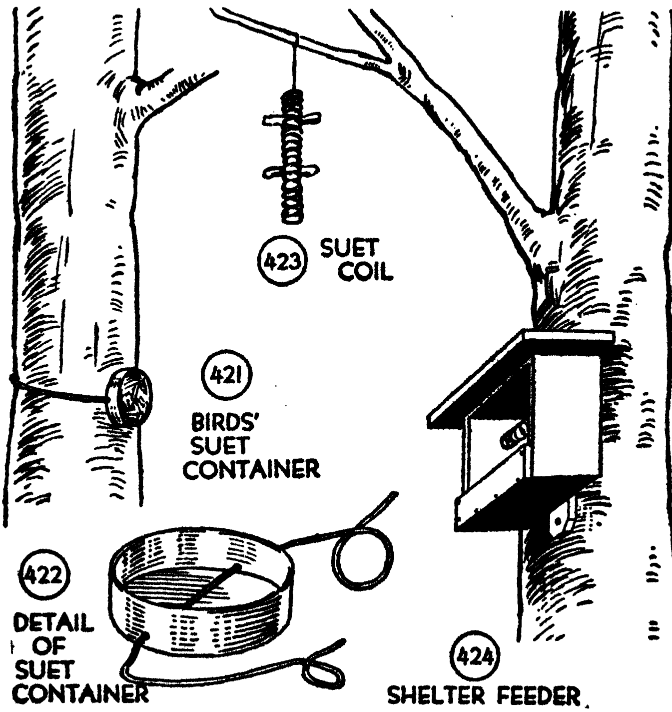
A SUET CONTAINER

The suet container shown strapped to a tree in Fig. 421 is a cover from a tin can. Punch a hole through opposite sides of the rim, as shown in Fig. 422, and run a copper or galvanized wire through the holes. Cut the wire so that it will reach around a tree trunk with ends long enough to lap and twist together.

TO FILL THE CONTAINER. Melt suet in a tin can or pan and pour it into the cover brimful.

A SUET COIL

The coil hanging from a tree branch in Fig. 423 is formed of heavy galvanized wire. Wind the wire



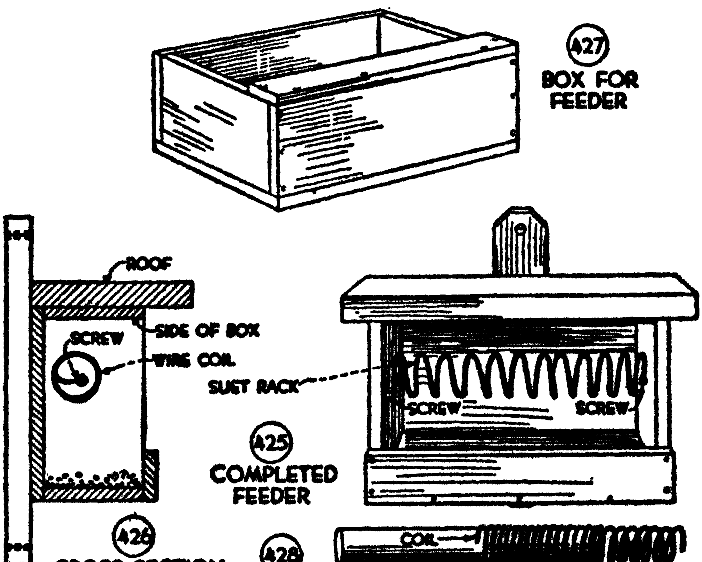
FIGS. 421-422. A BIRDS' SUET CONTAINER
FIG. 423. A SUET COIL
FIG. 424. A SHELTER FEEDER

around a broom handle, with the turns placed close together. Then pull on the ends of the coil to spread the turns about ½ inch apart. Cut off the wire,

leaving a straight end 16 inches long or longer to provide a hanger for suspending the coil.

A SHELTER FEEDER

The Foods Provided For. The winter feeder shown on the tree in Fig. 424 has a wire coil in which



Figs. 425-428. Details of shelter feeder

to place strips of suet, and a feeding table on which to throw bread crumbs, hemp, millet, sunflower seeds and poultry feed, or several of these forms of food.

The Feeder Box. Figure 425 shows a detail of the completed feeder. Figure 426 shows a cross section. Any small box, about 4 inches deep, 6 inches

wide and 12 inches long will do for the shelter. To prepare it, first nail a narrow strip of wood across its top, even with the long edge, as shown in Fig. 427. Then cut a piece of board large enough to make a roof with a projection of about 1 inch over the front ends of the box, and nail it to the side of the box as shown in Fig. 426.

Cut a hanger strap 2 inches wide and long enough to project several inches above and below the feeder box, and nail it to the center of the back.

The suet coil for the shelter feeder is easily made by winding a piece of galvanized wire around a broom handle as shown in Fig. 428, then slipping it off the handle. Bend the coil ends into loops, and screw these to the ends of the feeder box.

Hang the feeder upon the south side of a tree, at a height convenient to reach from the ground.

FINISHING

You will want to paint the winter feeders, to protect them from the weather. I suggest green or brown for the shelter feeder, and black or aluminum for the wire coils.

With your feeders placed and regularly stocked, you will have the satisfaction of playing host to a surprising number of species of birds. It is interesting to take a census of the birds that partake of your food offerings from the beginning of cold weather until

THE END.

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